Aalto University
School of Business

THE LABOUR MARKET SUCCESS OF UNIVERSITY AND UNIVERSITY OF APPLIED SCIENCES GRADUATES BETWEEN 2000 – 2016

An analysis of higher education choices in Finland

Master's Thesis

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Economics

Spring 2019

Aalto University School of Business

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Abstract of master's thesis

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Title of thesis The Labour Market Success of University and University of Applied Sciences Graduates between 2000 – 2016: An Analysis of Higher Education Choices in Finland

Degree Master of Science (M.Sc.)

Degree programme Economics

Thesis advisor(s) Matti Sarvimäki

Year of approval 2019 **Number of pages** 87 **Language** English

Abstract

It is well documented that the average higher education graduate in Finland earns more and has better employment prospects compared to non-graduates. However, information about the labour markets returns in relation to different higher education choices remains scarce. In this thesis, I study the labour market payoffs to different higher education choices when accounting for several observable differences in student composition. All in all, this paper explores university and university of applied sciences (UAS) graduates' early career earnings and employment figures from 36 different higher education institutions (HEIs), four fields of study and 78 different field of study-institution combinations between the years 2000 and 2016.

I find that a part of the raw average earnings differences between higher education graduates can be explained by the observable characteristics determined before students enrol in higher education. However, even after accounting for these characteristics, some differences remain when exploring graduates' early career earnings as well as employment prospects. For example, university graduate earnings differentials vary in the scope of €4,100 per year and UAS graduate around €7,900 per year between the HEIs when examining the variation in returns for different institutions. Furthermore, I find that the variation in returns for different fields of study is more substantial. For instance, studying a university business degree results in over €15,300 more per year compared to a university humanities degree early in a graduate's working career. The results also indicate that there is variation in returns to studying the same field of study at different institutions. For example, the best UAS institutions from the field of technology have returns that are around €7,000 more per year compared to the lowest yielding technology institution. These results imply that there seems to be variation in graduates' early career earnings both within HEIs across the different fields of study and within fields of study across HEIs. I also find that the probability of being in employment for graduates from any one of the various HEIs is rather high, well above 84%, which reflects the fact that having a higher education degree in Finland is a good investment against the risk of unemployment. Different field of study choices, however, induce more variation in the employment prospects of graduates. Graduates with business and technology related degrees are more likely to be employed early in their working careers in comparison to graduates with humanities degrees.

Overall, the results of this study are dependent on the limitations of the methodology and the provided data and, therefore, should not be interpreted as causal. The differences in earnings and employment prospects may also reflect differences in unobservable characteristics between individuals. Ultimately, this study suggests that there is a considerable scope for improvement in relation to the level and nature of information available to different stakeholders about the actual labour market returns to different higher education degrees.

Keywords higher education choice, selection on observables, labour markets, earnings, employment

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Maisterintutkinnon tutkielman tiivistelmä

Tekijä Otto Kasperi Leppänen

Työn nimi Korkeakoulutettujen menestys Suomen työmarkkinoilla vuosina 2000 – 2016: Eri korkeakouluvalintojen tarkastelu

Tutkinto Kauppatieteiden maisteri

Koulutusohjelma Taloustiede

Työn ohjaaja(t) Matti Sarvimäki

Hyväksymisvuosi 2019 **Sivumäärä** 87 **Kieli** englanti

Tiivistelmä

Tiedetään, että korkeakoulutetuilla on keskimäärin korkeammat tulot ja paremmat työllistymismahdollisuudet Suomessa verrattuna heihin, joilla ei ole korkeakoulututkintoa. Vähemmän tietoa on kuitenkin eri korkeakouluvalintojen ja tulojen tai työllistymisen välisestä yhteydestä. Tämän pro gradu – tutkielman tavoitteena on tutkia korkeakoulutettujen koulutusvalintojen tilastollista yhteyttä tuloihin ja työllistymisen todennäköisyyteen, kun vakioidaan yksilöiden lähtökohtaisia havaittuja ominaisuuksia. Kaiken kaikkiaan, tässä tutkimuksessa tarkastellaan yliopistoissa ja ammattikorkeakouluissa opiskelleiden alku-uran tuloja ja työllistymistä 36 eri korkeakoulusta, neljästä eri koulutusalasta ja 78 eri ala-korkeakoulu yhdistelmästä vuosina 2000 – 2016.

Tulokset osoittavat, että osa korkeakoulutettujen välisistä lähtökohtaisista keskimääräisistä palkkaeroista johtuvat yksilöiden havaituista ominaisuuksista, jotka määräytyvät ennen korkeakoulun valintahetkeä. Siitä huolimatta, kun vakioidaan korkeakoulutettujen havaittujen ominaisuuksien väliset erot, korkeakoulutettujen väliset alku-uran tulojen ja työllistymisen erot osaksi säilyvät. Esimerkiksi, eri yliopistoissa opiskelleiden vuositulot vaihtelevat 4,100€ välillä ja ammattikorkeakouluissa noin 7,900€ kun tarkastellaan eri korkeakoulujen estimaatteja. Lisäksi tulojen vaihtelu on suurempaa, kun tutkitaan eri koulutusalojen välisiä eroja. Esimerkiksi, kauppatieteellisen tutkinnon opiskelu yliopistossa johtaa noin 15,300€ korkeampiin korkeakoulutettujen alku-uran vuosituloihin verrattuna humanistisen tutkinnon opiskeluun yliopistossa. Löydökset osoittavat myös, että korkeakoulutettujen alku-uran tuloissa on myös vaihtelua, mikäli opiskelee samaa koulutusalaa eri korkeakouluissa. Esimerkiksi, parhaiden tuottavien tekniikan alan ammattikorkeakoulujen korkeakoulutetut ansaitsevat alku-uran aikana noin 7,000€ enemmän vuosittain verrattuna vähiten tuottavaan ammattikorkeakouluun tekniikan alalla. Nämä tulokset viittaavat siihen, että korkeakoulutettujen alku-uran tulot vaihtelevat sekä korkeakoulujen eri alojen välillä sekä alojen sisällä korkeakoulujen välillä. Tulokset osoittavat myös, että korkeakoulutettujen todennäköisyys työllistyä eri korkeakouluista on verrattain korkea, yli 84%, mikä kuvastaa sitä, että korkeakoulututkinnon suorittaminen on Suomessa hyvä investointi työttömyyden riskiä vastaan. Enemmän vaihtelua työllistymisen todennäköisyydessä on sen sijaan havaittavissa, kun tarkastellaan tarkemmin eri koulutusaloja. Kauppatieteellisen tai tekniikan alan tutkinnon omaavat ovat todennäköisemmin työllisiä uransa alkuvaiheessa verrattuna heihin, joilla on humanistisen alan tutkinto.

Kaiken kaikkiaan tämän tutkielman tulokset ovat riippuvaisia metodologian ja aineiston rajoitteista, ja tämän johdosta tutkimuksessa ei voida osoittaa syy-seuraussuhteita. Erot korkeakoulutettujen tuloissa ja työllistymismahdollisuuksissa voivat johtua myös yksilöiden havaitsemattomista työmarkkinamenestystä selittävistä tekijöistä. Pohjimmiltaan tämä tutkielma ehdottaa paremman ja tarkemman informaation tarjoamista eri sidosryhmille eri korkeakouluvalintojen todellisista tulo- ja työllisyysvaikutuksista.

Avainsanat korkeakouluvalinta, valikoituminen havaittujen tekijöiden mukaan, työmarkkinat, tulot, työllistyminen

Acknowledgements

This thesis is a result of many people's help and support and I would like to acknowledge their generous contributions. First and foremost, I would like to express my gratitude to my supervisor Matti Sarvimäki for all his useful advice and providing excellent guidance. I am also very appreciative to Oskari Nokso-Koivisto for getting this project underway. Similarly, a profound gratitude goes to The Finnish Education Evaluation Centre that provided me with the opportunity to join their team. Harri Peltoniemi, Hannele Seppälä, Helka Kekäläinen and the whole KOALA – team were all supportive along the way and always encouraged me with my work. It has also been a privilege to present part of this work to various stakeholders from all over Finland, including professors, rectors, students and labour market representatives. I thank them all for their insightful comments and suggestions for improvement. I also acknowledge the help of Statistics Finland for providing the data as well as the different higher education institutions involved in making this thesis possible. Special mentions to Larissa and Samuli Leppänen for giving valuable feedback, and Ingrid for the constructive comments. I would also like to express my great appreciation to my parents, and to Kirsten for her warm support. I finish by thanking Jean Tirole for inspiration and his wise words about how economics can be harnessed for the common good.

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1 Introduction

According to the “Vision for higher education and research in 2030”, initiated by the Ministry of Education and Culture, one of the main objectives is to increase the number of young adults with a higher education degree in Finland. The rationale for this is to have a skilled labour force to maintain a high level of competitiveness in the global markets as the comparative advantages and know-how needs change between countries (Ministry of Education and Culture, 2017a). Therefore, knowing the implications of higher education choices on labour market outcomes is important for society as it affects the decision making of many stakeholders. Before young adults enrol in post-secondary education, they will have to choose between different higher education institutions and degree programs.[1] This investment in human capital is perhaps one of the most important decisions an individual makes during his or her lifetime. Therefore, examining the labour market outcomes of different HEIs and field of study choices are of evident interest for those individuals about to invest in higher education. Furthermore, studying the labour market outcomes of graduates carries social importance. Policymakers want the publicly funded higher education system to increase the human capital of individuals, which is in turn associated with the increased productivity of individuals and companies and hence increased economic growth. Having new information about the earnings and employment of graduates is also essential for education policy when the government and HEIs decide on admission quotas for different fields.

Several papers have studied the return in relation to higher education choices across students who have graduated from different HEIs and fields of study. Most of this research has been conducted in the U.S. and Nordic countries, where some emphasis has also been in the Finnish context. A majority of studies from the U.S. find that the choice of HEI matters for labour market outcomes in terms of lifetime earnings (see, e.g., Behrman et al., 1996; Hoekstra, 2009) whereas research conducted in the Nordic countries finds less evidence of this (Eliasson, 2006; Öckert, 2010; Suhonen, 2013;2014; Kirkeboen et al., 2016). Nevertheless, a proven finding from many countries is that there exist significant earnings differences across fields of study (see, e.g., Altonji et al., 2016). For example, finishing a university degree in business and technology typically leads to higher average earnings than a degree in arts or education (Suhonen and Jokinen, 2018). It is not clear, however, if the differences in labour market outcomes are because different types of people choose a

[1] Higher education institutions in Finland consists of universities and universities of applied sciences. Henceforth, I will abbreviate higher education institutions as HEIs and universities of applied sciences as UAS.

specific degree in a particular HEI or a result of differences in degrees and HEIs as such. These earnings differences, at any rate, cannot only be rationalised by ability differences across fields, implying that the field of study choice affects earnings also through a causal effect (Arcidiacono, 2004; Hastings et al., 2013; Kirkeboen et al., 2016).

This thesis examines the labour market success of university and UAS graduates between 2000 – 2016 in Finland.[2] Through a descriptive analysis, this paper explores graduates' early career earnings and employment from different HEIs and fields of study after accounting for differences in student composition. In essence, this thesis follows a similar framework as Belfield et al. (2018) when exploring the labour market outcomes of graduates. The empirical results distinguish three levels of analysis; the relationship between the institution, field of study and field of study-institution combination and subsequent graduate earnings and employment ten years after the individuals first enrolled in higher education. In total, this paper includes results from 13 universities, 23 UAS, four fields of study (business, humanities, social sciences and technology) and 78 different field of study-institution combinations. Also, this paper summarily explores whether there is heterogeneity across genders in the results.

This paper combines several data sets collected by Statistics Finland to examine the research questions. The data sets allow the exploration of graduates' early career earnings and employment figures between 2000 and 2016 and consists of individuals between the ages of 28 and 35. The data sets include rich information on essential individual attributes such as gender, mother tongue, high school region and educational attainment. Furthermore, the Matriculation Examination Register provides the matriculation examination grades, which are one of the central control variables used in this study as they serve as a good measure for initial academic ability.

The main econometric problem in estimating the effect of individuals' higher education choices and their returns arises from the non-random nature of HEI and field of study selection. It is ambiguous as to whether the labour market differences between individuals are due to differences in the chosen HEIs and degree programs or because of differences in observable (e.g. school grades and family background) or unobservable individual characteristics (e.g. innate ability, motivation, ambition) between graduates. To tackle this econometric challenge, this study relies on selection on observables and multiple linear regression to examine higher education choices and labour market outcomes. An attempt to

[2] Those enrolled in higher education degree programs are referred to as graduates throughout this thesis.

disentangle the selection problem is made by controlling for a substantial set of graduates' observable pre-higher education characteristics, most notably matriculation examination grades and high school region. Nevertheless, due to the problematic feature of identifying unobservable individual characteristics, the results from this paper are descriptive and do not attempt to unfold causal effects of HEI and field of study choices on labour market outcomes.

Overall, this thesis contributes to previous literature related to the returns of higher education choices. Currently, there are only a limited number of studies available that use Finnish data to examine higher education choices and labour market outcomes (see, e.g., Suhonen, 2013;2014; Suhonen and Jokinen, 2018). Furthermore, according to my knowledge, this is the first study to incorporate Finnish universities, UAS as well as different field of study-institution combinations in the same analysis that uses observations collected over several time-periods. Ultimately, the uniqueness of this paper derives from the detailed nature of the data, in other words, the new and extensive data in terms of occupational information, income figures, individuals' educational attainment, matriculation examination grades and other essential background characteristics.

The results of this paper can be summarised in the following way. Firstly, at the outset, there is significant variation in the raw earnings across different HEIs, fields of study and field of study-institution combinations. Some of this variation is because, initially, certain degrees attract high-ability and high earning students. Once the observable differences in the student composition between HEI programs have been accounted for, the variation in returns is reduced but some differences remain when exploring graduate earnings and employment prospects ten years after the entry decision in higher education. First of all, university graduate earnings differentials vary in the scope of €4,100 per year and UAS graduate around €7,900 per year between the HEIs when examining the variation in returns for different institutions. As the average graduate's earnings per year is between €33,000 and €34,000 in the samples, these earnings differences between institutions can account for variation to some extent if these differences remain or grow over the lifecycle. These results suggest more variation in graduates' earnings compared to previous evidence from the Nordics. However, the examination of the preferred specification also reveals that not all of the HEI estimates are statistically significant. Secondly, the results also show that the different fields of study used in this analysis have different payoffs even after accounting for various background characteristics of students and institutional quality. This variation in returns in relation to different field of study choices is larger in comparison to the institution estimates. For example, studying a university business degree results in earnings of over €15,300 more per year compared to a university humanities degree early in a graduate's working career. These results are consistent with previous empirical studies which also find evidence of earnings differences across different fields of study. Thirdly, the findings of this paper suggest that studying the same field of study at different institutions yield different earning premiums. For instance, the best UAS institutions from the field of technology have returns that are around €7,000 more per year compared to the lowest yielding UAS technology institution. Therefore, there appears to exist variation in graduates' early career earnings both within HEIs across the different fields of study and within fields of study across HEIs. At any rate, many of the field of study-institution combination estimates should be interpreted with caution because of the small sample sizes used in this analysis. Finally, this paper also shows that there is some variation in the probability of being in employment for graduates in their early careers resulting from different HEI and field of study choices. In general, however, the results from this paper show that the probability of being in employment for graduates from any one of the various HEIs is rather high, well above 84% which reflects the fact that having a higher education degree in Finland is a good investment against the risk of unemployment. More variation in the probability of being in employment, however, occurs on closer examination of the different field of study estimates. University and UAS graduates from the fields of business and technology have a significantly higher probability of being employed, ranging from 86% to 90%, in comparisons to graduates from the field of humanities of which around 78% are in employment.

In interpreting these findings, several things should be acknowledged. Part of the earnings differences found in this study can be explained by unobservable factors such as preferences and various soft skills that are not accounted for in this study that also determine labour market outcomes. Furthermore, some of the differences in returns can arise because of the varying locations of the HEIs. Students who graduated from metropolitan HEIs might systematically access the better paid metropolitan labour markets. Eventually, this analysis focuses solely on the private monetary labour market outcomes of different higher education choices. There are noticeably many non-monetary gains for individuals, such as job satisfaction, from enrolling into different higher education programs. In addition, participation in higher education is also accompanied by several positive externalities, such as the social returns associated with acquiring a higher education degree. While acknowledging these potential gains, the measurement of them is beyond the scope of this analysis.

The remainder of this thesis is organised as follows: Section 2 introduces the previous literature relevant to the topic and the associated main findings. This literature review presents the theoretical framework for this thesis and together with the empirical background helps address the research questions. Section 3 then draws the study to the Finnish context and brings forth the institutional background of the Finnish higher education system. Next, Section 4 describes the data used and presents illustrative descriptive statistics. Section 5 then introduces the empirical strategies employed. Section 6 presents the main findings where the empirical results are analysed. Finally, Section 7 concludes.

2 Literature review

In this section, I present the relevant theoretical framework and previous empirical research. I begin by explaining the main theoretical concepts and the mechanisms of the returns to higher education. Then, I introduce the underlining econometric problem that arises when estimating the effect of individuals' higher education choices and their returns. Once the above-mentioned conceptual framework has been formulated, and its implications understood, I subsequently present the results obtained and review the methods used in the previous empirical literature.

2.1 Theoretical background and mechanisms

One of the most studied research subjects in labour economics is investigating the economic returns to education. A typical result has been that obtaining more schooling has a positive causal effect on one's lifetime earnings (e.g., Angrist and Krueger, 1991; Ashenfelter and Krueger, 1994; Card, 2001). For example, research shows that having a higher education degree in Finland is still a very profitable investment (Koerselman and Uusitalo, 2014; Suhonen and Jokinen, 2018).[3] There are two main theoretical approaches used to explain the differences in the economic returns for different higher education choices. The first is the productivity increasing explanation pioneered by Schultz (1961) and further developed by Becker (1962) and Mincer (1974). As different HEIs and degree programs can accumulate different amounts and types of human capital for an individual, this can induce productivity differences across students which can influence their labour market outcomes in terms of earnings differences. The second is the ability signalling explanation of Spence (1973). A degree that a graduate obtains from a specific HEI can serve as a signal of high productivity and high-ability for the labour markets.

Even though both the human capital and signalling theory conclude that earnings rise with education, the policy implications are different. Unlike in human capital theory, pure signalling theory does not require that the HEI or the degree program increases the productivity of the individual during his or her studies. Therefore, if the causal relationship between higher education choices and earnings is explained because of human capital theory, investing in the higher education system is beneficial for the society as it has

[3] According to the recent estimates by Suhonen and Jokinen (2018), the highest income group (those with a master's or a doctoral degree) had $2 - 2.4$ times higher earnings after taxes compared to those who only completed compulsory education.

production value and increases economic growth. If the relationship, however, is due to the signalling effect, investing in the higher education system supports economic growth only in a way that it promotes a better match between workers and jobs. It has no impact on productivity and, thus, is not valuable for society as a whole (Fang, 2006; Hämäläinen and Uusitalo, 2008).

There have also been studies to uncover the mechanisms whether through the human capital accumulation or the signalling channel, of how the choice of attending a so-called prestigious or elite HEI affects earnings (see, e.g., Lang and Siniver, 2011; Hershbein, 2013; Suhonen, 2014).[4] In the US context, Hershbein (2013) finds that most of the returns from the choice of a selective HEI arise through the signalling channel. The study by Lang and Siniver (2011), on the other hand, finds that the increase in the earnings premium on graduating from a prestigious Israeli university decreased over time with the accumulation of work experience. The authors explain that as the employers learn the true ability of their employees the impact of the signal diminishes. In addition, peer effects can exist in higher education. Being in the company of successful students can have a positive effect on one's human capital build-up (Sacerdote, 2001).[5] For example, students can learn a lot of new skills by interacting directly with their peers, both inside and outside their university. Furthermore, these peers can help each other out in the labour market, primarily after they have established themselves, by creating active networks (Lang and Siniver, 2011). In the Finnish context, Hämäläinen and Uusitalo (2008) utilise data from a natural experiment of the extensive Finnish UAS reform to differentiate the impact between human capital and signalling theories of the value of education. The reform effectively transformed several vocational colleges into UAS by enhancing the level and increasing the time in education in those schools between 1992 – 2000 to meet the increased demand for skilled labour. The authors conclude that most of the increase in earnings of UAS graduates was due to the signalling value; however, the increase in human capital also played a part. In a more recent study, Suhonen (2014), instead finds tentative evidence that graduating from an HEI with a high teacher/student ratio seems to be on average favourable for women's labour market success. The author suggests that this result is primarily due to accumulated human capital effects deriving from higher education quality.

[4] Most often, the selectivity of the institution is used as a measure for institutional quality and categorises certain universities and colleges as "prestigious" or "elite".

[5] Sacerdote (2001) exploits randomised settings to study these peer effects of college roommate quality on academic and other outcomes in Dartmouth College where first-year students are randomly assigned into rooms and dorms. The study suggests that a roommate's high GPA is positively correlated with the student's GPA.

This thesis does not attempt to separate the different mechanisms of human capital accumulation and signalling channels when examining the labour market outcomes of the different HEI and field of study choices as it is difficult to estimate what is explained by human capital theory or signalling theory. Both theories have identical predictions and can impact each other (Hämäläinen and Uusitalo, 2008). An HEI could, for example, increase the human capital of students by providing superior instruction and later on receive recognition of being a top institution. In this case, the labour markets would interpret studying in that institution as a signal of productivity. Nevertheless, previous research seems to support the view that both human capital accumulation as well as the signalling channel influence earnings (e.g., Hämäläinen and Uusitalo, 2008; Lang and Siniver, 2011; Hershbein, 2013).

The point of departure of this paper, as well as the centre of interest in previous academic literature, is to uncover the human capital accumulation ability, in other words, the "added value" impact of different HEIs and fields of study on graduates measured in terms of earnings and employment. However, measuring the impact of individuals higher education choices and their returns is challenging (Suhonen, 2015). A problem that arises in the econometric modelling of higher education choices and their payoffs is unobserved individual characteristics which can be correlated with both explained and explanatory variables of the models. These unobservables can be individual characteristics such as innate ability, motivation and ambition. For instance, students attending selective and high-quality universities might be initially of higher ability compared to students in lower quality universities. Therefore, the estimate of interest can potentially be upward-biased as individuals with higher initial ability are often associated with higher earnings. Furthermore, estimating the payoff of choosing one type of education in comparison to another is difficult because individuals are deciding between different types of education. This would require information about how individuals rank different types of education to recognise the payoff to an individual choosing one type of education instead of another (Kirkeboen et al., 2016). Simply put, hypothetically a reliable, although not unambiguous, method to establish a causal connection between individuals' higher education choices and labour market outcomes would be to organise a randomised field experiment. For example, a randomly chosen group of young students who have finished high school could be randomly assigned to two different types of HEIs: low- and high-quality HEIs (in this case, quality could be measured, for example, in terms of educational resources). The recently graduated students from both types of HEIs would then enter the labour markets and be assessed based on their labour market outcomes. This hypothetical setting would allow some causal inference by evaluating the mean averages between the groups; however, it is highly unlikely to find participants for this type of an experiment as chance would determine who receives the high-quality or low-quality education (Suhonen, 2015). Consequently, several different non-experimental approaches have been used to alleviate some of the biases arising from the non-random sorting of students to different HEIs and fields of study.

2.2 Previous empirical literature

For the purpose of this paper, the previous empirical literature can be divided into those studies looking at the effect of HEI choice and those that also consider the field of study choice on labour market outcomes. Most of the literature focusing on the labour market effects of HEI choices explores data from the United States (e.g., Black and Smith, 2004;2006; Hoekstra, 2009; Dale and Krueger, 2002;2011). Although, several studies have also been conducted in the Nordic countries (Eliasson, 2006; Öckert, 2010; Suhonen, 2013;2014; Borgen, 2014; Kirkeboen et al., 2016) and a few elsewhere (Chevalier and Conlon, 2003; Saavedra, 2009; Lang and Siniver, 2011). Specifically, most of the studies from the U.S. focus primarily on the relationship between the selectivity of the HEI and earnings.[6] Overall, the majority of findings from the U.S. argue that a selective HEI has a positive impact on labour market outcomes (see, e.g., Behrman et al., 1996; Hoekstra, 2009). However, there are some conflicting results (Dale and Krueger, 2002;2011). For instance, while Hoekstra (2009) finds convincing results that a particular selective HEI increases earnings around the entrance threshold by 20%, Dale and Kruger (2002;2011) find no significant effects of attending selective HEIs.

Research conducted in the Nordics, however, finds less evidence that HEI choices have a significant impact on labour market outcomes (Eliasson, 2006; Suhonen, 2013;2014; Öckert, 2010; Kirkeboen et al., 2016). Most relevant to the present study, Suhonen (2013;2014) finds little evidence that the HEI choices as such have an impact on the returns to education. For example, Suhonen (2013) reveals that graduating from the Helsinki metropolitan area, where one would expect to offer students a more beneficial environment compared to the other nine university cities – in terms of the quality of peers, academic staff and job opportunities – did not translate into higher early career earnings when considering the differences in graduates' pre-HEI characteristics. Taken together, many of the studies

[6] In these studies, selectivity is usually used as a measure for quality and is measured by students' average SAT-scores. The popularity of using this measure is because standardised tests make it easy to measure selectivity.

carried out in the Nordics also find that the effect on earnings from attending a more selective institution is influenced by the different payoffs to different fields of study.

Furthermore, there exist a few available studies from other countries. Studies from the United Kingdom find a positive impact of graduating from prestigious HEIs (Russel Group universities) after accounting for differences in student composition. Chevalier and Conlon (2003), for instance, find a small earnings premium of $0-6\%$ for men who graduated from Russel group universities than those from Modern universities. Belfield et al. (2018), instead, discover that Russel Group universities provide the highest returns with around 10% more than an average institution. All in all, however, the available studies conducted in other countries in comparison to the U.S, mainly, find weak and ambivalent evidence for earnings premiums for HEI choices.

Overall, the results from the Nordic countries as well as generally speaking in other countries have produced less evidence on the impact of HEI choices on labour market outcomes as opposed to studies conducted in the United States. A potential reason for this is that the U.S. has a heterogenic HEI system and large income differences whereas, for instance, the Nordics are known for the opposite: having low-income differences and arguably quality-wise a homogenous publicly funded higher education system. Furthermore, the effects can be greater in locations with more private financing for the higher education system.

Yet, it is well documented that annual earnings differ noticeably across different higher education degree programs. Numerous international studies conclude that the field of study choice is a key source of future earnings and is emphatically correlated with the types of occupations people have (see, e.g., Altonji et al., 2016). For example, finishing a university degree in business or technology typically leads to higher average earnings than a degree in arts or education. However, the choice of field appears also to impact earnings through a causal effect (Arcidiacono, 2004; Hastings et al., 2013; Kirkeboen et al., 2016). Most recently, using a rich administrative data set from Norway's tertiary education system and a convincing regression discontinuity design, Kirkeboen et al. (2016) present persuasive proof implying that a degree in business, engineering, medicine or law has indeed also a positive causal effect on earnings compared to other alternatives.[7] In addition, the authors conclude that Norwegian students select into different fields depending on their comparative advantages. Hastings et al. (2013) likewise use discontinuities from the centralised, score

[7] The authors employ a 2SLS - fuzzy RD design that uses instruments depending on whether the index of grades and test scores surpasses the program-specific admission thresholds (Altonji et al., 2016; Kirkeboen et al., 2016).

– based admissions systems in Chile to determine the earnings effects of going over the threshold for admission to a favoured degree. The authors find positive payoffs to the most selective degrees as well as degrees in health, science and social science fields.

The Finnish institutional setting does not have an equivalent centralised higher education admission procedure that would allow the exploitation of similar fuzzy regression discontinuity approaches, such as in Chile (Hastings et al., 2013) or Norway (Kirkeboen et al., 2016) to estimate causal effects of different HEI and field of study choices on labour market outcomes of graduates. Nevertheless, recent descriptive studies in Finland find that earnings differences exist across degree programs. Closely related to this thesis in terms of a similar method used, Suhonen and Jokinen (2018) examine the returns to several higher education degree programs by using a regression model with a fresh data set that control for several pre-school characteristics. The return to education varies significantly across fields of study and, what is more, the trends in earnings also fluctuated across time. For example, in 2015 while university degrees such as in industrial engineering and management had over treble earnings compared to those who only completed compulsory education, the figure was significantly lower (around double) with other university degrees such as in mathematics or biotechnology. Furthermore, there was also fluctuation between earnings across time: between 2005 – 2015 the return on a UAS architecture degree increased by four percentage points a year compared to those who only completed compulsory education, while there was a slight adverse yearly effect on UAS information technology degrees.

2.3 Measuring economic returns

The development of the Mincerian earnings equation which provides an explanation for individuals earnings by their years of schooling and work experience, was a starting point for researchers to measure the economic returns to education (Mincer, 1974). Even with the strong evidence of a positive correlation between education and labour market success, social scientists have been careful to establish firm conclusions about the causal effects of different types of schooling. In particular, without experimental evidence, it is problematic to know for certain whether the greater incomes for more educated individuals arise from their HEI and field of study choices or whether individuals with higher earning potential self-select into high earning degrees (Card, 1999). At any rate, prior research has used different quantitative methods for non-experimental data to deal with observable and unobservable determinants. These approaches can be roughly divided into two categories: selection-on-observables and selection-on-unobservables (Suhonen, 2015). The former category considers that the selection into an HEI and a field of study is based on only observable factors, whereas the latter category factor in that the selection is also dependent on unobservable factors.

Based on the classification by Suhonen (2015), regression models and propensity score matching methods are in the first category which mainly controls for observable factors. Prior studies use different forms of regression models as a benchmark approach (see, e.g., Black and Smith, 2004; Eliasson, 2006; Lang and Siniver, 2011; Altonji et al., 2016; Belfield et al., 2018) due to the simple tactic and good estimate efficiency of the method.[8] Moreover, the strength of regression models in comparison to other methods is that they allow for multidimensional analysis of different variables which is useful in the present study. However, a problematic feature that arises with regression modelling of individuals' higher education choices and their payoffs is unobserved individual characteristics. Innate ability, ambition, motivation and other soft skills, for instance, can be correlated with both the explained and explanatory variables of the model. Consequently, the model can produce biased estimates. Furthermore, regression models are criticised because of the strong assumption that they are of linear functional form which results in the omission of a relevant control group. For instance, it is difficult to find a control group for individuals with the same high abilities but who go to a lower quality HEI instead of a higher quality one. The omission or the lack of this type of control group is called the common support problem (see, e.g., Angrist and Pishke, 2008, p.57). In particular, this study uses a multiple linear regression analysis method to examine HEI and field of study choices and labour market outcomes. However, using this approach will only produce descriptive results rather than a causal estimation due to the method's limitations in respect of not being able to take into account unobservable ability and selectivity. Section 5 will go in to further depths in relation to the regression methods used in this study and will explain in more detail the methods' strengths and limitations.

The propensity score matching method offers a more transparent way to control for observable factors (Black and Smith, 2004; Eliasson, 2006) compared to regression models. Essentially, this method compares individuals who have the same expected probability to be selected to an HEI. The propensity score matching and regression model methods both rely on the same assumption that selection into HEIs and fields of study are only based on observables that are related to labour market outcomes. If this assumption holds, the propensity score matching method can produce more robust results due to lower functional

[8] Suhonen (2015) includes ordinary least square (OLS), quantile regression, probit-models, logit-models, duration models in the definition of different regression models used in previous literature.

form requirements than with regression methods. However, if the assumption does not hold, the propensity score method suffers from the same limitations as regression models (Suhonen, 2015).

The second category includes several methods that rely on selection-on-unobservables. In previous studies, issues originating from selection have been dealt with by studying, for instance, identical twins and siblings (Behrman et al., 1996; Lindahl and Regnér, 2005) and using self-revelation and matched applicant models (Dale and Krueger, 2002). Taking advantage of the fixed effects of identical twins and siblings can potentially deal with some of the problems arising from unobservables.[9] In fact, the estimates obtained using this method have been smaller compared to the results from regression models indicating bias in the estimates of regression models (Behrman et al., 1996; Lindahl and Regnér, 2005). Nevertheless, there have only been a few studies using identical twins and siblings to assess the impact of HEIs due to limited available data on twins and siblings. Self-revelation and matched applicant models, instead, also partly consider some of the unobservable factors.[10] The results using this method have produced two-fold results; while the results by Dale and Krueger (2002;2011) are different compared to results attained by using regression models, others fail to find significant differences (e.g., Broecke, 2012; Borgen, 2014). At any rate, as is the case with fixed twins and siblings' models, self-revelation and matched applicant models fix only part of the problem related to unobservables.

Finally, approaches that are also included in the second category are studies that use an instrumental variables method (Black and Smith, 2006; Long, 2008; Suhonen, 2013;2014; Borgen, 2014) and a regression discontinuity design (Hoekstra, 2009; Öckert, 2010; Hastings et al., 2013; Abdulkadiroglu et al., 2014; Kirkeboen et al., 2016) to correct biased estimates resulting from unobserved individual characteristics. Using an instrumental variables (IV) method yields accurate estimates that fix some of the biases related to unobservables and measurement error. Nevertheless, this method has its limitations as it is difficult to find valid and relevant instruments. Regression discontinuity design methods, on the other hand, are considered to be the next best method to estimate causal effects arising from HEI choices after an impracticable randomised field experiment (Suhonen, 2015). By utilising discontinuity in the explanatory variables around the cut-off scores to different HEIs, this method compares individuals that are barely accepted to an HEI to individuals who are

[9]By comparing twins or siblings with each other, it is possible to control for numerous hardly observed factors such as family or neighbourhood background effects that can explain HEI choices (Lindahl and Regnér, 2005).

[10]These models examine similar types of applicants who apply to comparable HEIs or who get accepted or rejected from similar HEIs.

just barely rejected due to slightly lower points. Both of these types of individuals (barely accepted/rejected) can be thought to have similar observed and unobserved individual characteristics. The strengths of regression discontinuity design approaches are the method's transparency and a high degree of internal validity. However, a weakness of this method arises with the threat of low external validity; the results apply to individuals around the entry threshold and therefore generalising the results in respect of the whole population can be of limited value.

Each of the approaches used in previous literature has its strengths and weaknesses, and thus it is difficult to arrange them in rank order. At any rate, approaches that use selection-on-unobservables compared to selection-on-observables are considered better in the relevant literature as they result in estimates that allow for a more causative instead of correlative interpretation. Especially, regression discontinuity design methods have produced convincing results for causal inference (see, e.g., Hastings et al., 2013; Kirkeboen et al., 2016).

3 Institutional setting

Given that the theoretical framework and the results and methods in previous research have been presented, this section draws the study to the Finnish context. More precisely, this section describes the path to higher education and gives further insight into the main characteristics of the higher education system in Finland.

3.1 The pathway to higher education

In Finland, compulsory education starts at age seven and finishes when the basic education curriculum has been completed or when ten years have elapsed since the beginning of compulsory education. Typically, the student has finished with compulsory school at the age of 16. The completion rate of compulsory education in Finland is very high: 99.7% of the children graduate from comprehensive schooling (Finnish National Agency for Education, 2016).

After compulsory school, over 90% of the cohort will continue to study at the upper secondary school which typically lasts for three years. Upper secondary school is separated into two tracks: general and vocational upper secondary education. Of those students who proceed to upper secondary school around half will select the more academically oriented general track compared to the upper secondary vocational school. A double degree taking both vocational and matriculation is also possible which usually takes four years to complete. The general track, which ends with the national matriculation examination, is still the primary channel that students continue to use to proceed on to post-secondary education. However, eligibility for higher education is granted by all tracks in upper secondary education (Ministry of Education and Culture, 2016; Pekkala Kerr et al., 2018).[11]

At the end of general upper secondary school students take part in the Matriculation Examination which grants the general eligibility for university as well as UAS studies. The examination includes four compulsory exams and, if the student wishes, one or more optional exams. The four compulsory exams consist of mother tongue (either Finnish or Swedish) and three of the following subjects: second national language (Finnish or Swedish),

[11] In autumn 2016, the majority of students who had accepted their higher education place had completed their matriculation examination test: around 95% of those in universities and 62% of those in UAS (Ministry of Education and Culture, 2017b).

foreign language, mathematics or a science and humanities exam.[12] The matriculation examination is held twice a year, in spring and autumn. The examination is national and is marked by the Matriculation Examination Board which is an external body. The scores of the matriculation examination are standardised to guarantee comparability across years.

3.2 The Finnish higher education system

The Finnish higher education system is publicly financed and consists of two institutional actors: universities, with around 52% of the total number of students and UAS with approximately 48% of the total number of students in 2016 (Statistics Finland, 2017a). Universities are more academically orientated whereas universities of applied sciences focus on advanced vocational education. The admission system is centralised; however, most of these HEIs use a combination of entrance examinations and achieved national matriculation examination scores to select prospective students for admission. Specifically, universities and universities of applied sciences can freely compose and design their program-specific entrance exams which are usually based on study material not taught in upper secondary school. In a given year, the applicants can apply for up to seven university programs and four UAS programs. After being accepted, switching between programs is difficult, and students often obtain their final degree from their initial program (Ministry of Education, 2017b; Pekkala Kerr et al., 2018).

The higher education system consists of 13 universities and 23 UAS.[13] Universities are corporations under public law except for two (Aalto University and Tampere University) that are foundations. UAS are public limited companies. The optimal duration of university studies is approximately 5 – 7 years depending on the field of study and often results in a degree such as Master of Science. Graduating from a UAS, on the other hand, takes 3 – 4 years and provides education at bachelor level (e.g. BBA and engineering). However, it is also possible to gain a master's degree from a UAS which usually requires three years of work experience after the completion of a bachelor's degree to be accepted in a master's programme. It is also possible to apply for a master's degree program directly at a university after completing a bachelor's degree at a UAS. There are no tuition fees for enrolling into universities or UAS for students in Finland.[14]

[12] For a thorough description of the Matriculation Examination visit http://www.ylioppilastutkinto.fi.

[13] The Finnish National Defence University, Police University College, Åland University of Applied Sciences are not included in these figures as they operate under different administrations than the Ministry of Education and Culture (Ministry of Education and Culture, 2018).

[14] The tuition fees vary for students who enrol from outside the EU/EEA area.

The primary source of funding for universities and UAS comes from the state budget from the Ministry of Education and Culture.[15] The Ministry of Education and Culture (2017c;2018) distributes the main core funding by employing specific financing models for the two types of HEIs. Even though the government guarantees autonomy for each HEI to decide on matters relevant to its internal administration, the significant proportion of public funding can steer the institutions' operations. For example, a big part of the funding to HEIs is allocated by the number of targeted and completed degrees. In essence, this creates incentives for the universities and UAS to attract hard-working students that will complete their degrees (Ministry of Education and Culture, 2017c). In terms of financing the public higher education system, Finland spends 1.7% of its GDP to capitalise on the higher education system. Compared to the average of OECD countries (1.1%) it ranks top with the Nordic countries (OECD, 2017).

On the whole, since the establishment of the Finnish higher education system, a fundamental principle has been to guarantee equal access to higher education for the prospective students irrespective of, for instance, family income and region of residence. In addition to there not being any tuition fees, studies are also in general publicly subsided with generous social benefits such as study grants, housing allowances and access to government guaranteed student loans. Furthermore, the regional distribution of the HEIs to cover mainly all parts of the country ensures sufficient regional accessibility. Therefore, arguably no significant financial or geographical barriers for students are involved in the enrolment into higher education in the Finnish context.

[15] In addition, to the core funding, higher education receives external funding from other sources. These include the Academy of Finland, The Finnish Funding Agency for Innovation (Tekes), the European Union, enterprises, foundations and other international sources (Ministry of Education and Culture, 2017c).

4 Data

Now that that the Finnish institutional setting has been laid out, this section provides an overview of the data used in this study. I first go through the datasets and describe how the two samples were constructed. Next, I provide the exact definitions for the different variables used in the empirical analysis. Finally, I present the descriptive statistics of the samples and selected variables which offer an insightful review of the data at hand.

4.1 Data overview

The data collected for this empirical study comes from several administrative registers provided by Statistics Finland and the Finnish Matriculation Examination Board. The datasets used in this study links the five following datasets:

- FOLK basic data module (years 1988 – 2016)
- FOLK income data module (years 1988 – 2016)
- University Student module (years 1986 – 2015)
- UAS Student (Individual-based) module (years 1999 – 2017)
- Matriculation Examination Register (years 1990 – 2017)

The FOLK basic data module provides rich information on essential individual attributes such as gender, mother tongue, educational attainment, occupational status and field of study choices for UAS students. The FOLK income data module, on the other hand, provides accurate work and entrepreneurial income figures which have been inflation-adjusted using money value multipliers (Statistics Finland, 2017b). The University Student module gives information about the university institution name, field of study, granted degree name and the year when the student was first enrolled at a university. The UAS Student (Individual-based) student module, instead, supplies information about the UAS institution name as well as the year the student was first enrolled at a UAS.[16] Finally, the Matriculation

[16]Those who have enrolled in higher education degree programs are referred to as graduates throughout this thesis. The datasets at hand, however, do not provide information whether a student has officially graduated, dropped out or switched HEIs or degree programs after enrolling to his/her first higher education choice. These limitations should be recognised when interpreting the results. At any rate, as 84% of

Examination Register provides the matriculation examination grades and the high school region. The matriculation examination grades are one of the central control variables used in this study as they serve as a good measure for academic ability. Notably, this study uses the highest grade in the first language and advanced or basic maths a university or a UAS student received in the matriculation examination.

The main strength of the Finnish registry data is its high-quality by international standards. Unlike the different types of survey data used in many of the previous empirical research conducted in the U.S., studies from Finland and other Nordic countries are based on administrative data collected by statistics officials.[17] In the context of this study, administrative data allows covering a range of variables that are not usually compiled in survey data. This is possible in the Nordic context as administrative data is constructed on different registers where unique national identification numbers connect essential information about individuals (Eliasson, 2006). Furthermore, an advantageous feature of the Finnish registry data is that the earnings figures used in this study are from filed tax reports, so the measurement errors due to misreporting should be small.

4.2 Sample formation

This study constructs two samples from the datasets mentioned above. The records from the datasets are combined using the unique national identification number for each individual. The first sample is comprised of those individuals enrolled in their first university degree course, and the second sample is comprised of those enrolled in their first UAS degree course.[18] Both samples have only individuals who have enrolled in a degree course within the fields of business, humanities, social sciences and technology.[19] There are two reasons for having separate samples for university and UAS graduates which should be taken into account when interpreting and comparing the results of these two samples. Firstly,

individuals in the university sample and 89% of individuals in the UAS sample are in employment rather than being unemployed, students or outside the workforce, the data provides a suitable setting to examine the labour market outcomes of different HEI choices.

[17]Several expert organisations in the field of public administration produce the statistics of The Official Statistics of Finland (OSF), see `http://tilastokeskus.fi/til/tuottajat_en.html`.

[18]In the university sample, those enrolled in their first higher education degree include those graduates who were granted permission to pursue a bachelor's or a master's degree program. In the UAS sample, there are only individuals who were enrolled in their first bachelor's degree program.

[19]The university sample includes all of the four fields of study (humanities, social sciences, technology and business) whereas in the UAS sample social sciences are not included. In the UAS sample, the five institutions that offer humanities also include some arts-related degrees as it was not possible to separate these with the data at hand.

as the essential information about the HEI and field of study choices comes from two separate modules for university and UAS graduates, they cover a different span of years. The University Student module allows examining earnings and employment figures with a more extended time-period, and consequently, the university graduate sample has more observations. Secondly, the information about the field of study is categorised differently for university and UAS graduates with the data at hand. For university graduates, there is information about the name of the university institution and the name of the precise granted degree for studying a specific field of study. The information about the UAS institution name for UAS graduates comes from the separate UAS Student (Individual-based) module which does not include information about the graduates' field of study choices or granted degree names. Therefore, the field of study information for UAS graduates comes from the FOLK basic data module which is not as precise as it does not include the granted degree name as in the University student module for university graduates.[20] Nevertheless, both samples are linked to the same demographic and income information as well as to the matriculation examination grades.

This study examines the earnings and employment figures ten years after the individuals enrolled in their first university or UAS degree. The University Student module begins in the year 1986, however, the matriculation examination grades are only available starting from the year 1990. Therefore, as the earnings and employment figures are available until 2016, the final university graduate sample covers the information about graduates' earnings and employment between the years 2000 and 2016. The UAS graduate sample, on the other hand, has a shorter time span and covers the years 2009 to 2016 because the UAS Student (Individual-based) module begins in the year 1999. As a result, this study examines the labour market success of reasonably recent higher education graduates. Furthermore, to exclude those individuals who might have done another higher education degree while also having gained significant labour market experience, both samples are restricted to look at those individuals who enrolled in their first HEI degree program between the ages of 18 to 25. Hence, this allows for exploring the earnings and employment figures of individuals between the ages of 28 and 35.

The main outcomes of interest — the earnings and employment figures that are examined ten years after a student first enrolled in a university or a UAS degree program — provide an idea of the potential labour market experience the graduates in the samples have. For

[20] For instance, in the university sample, it is possible to distinguish those that have enrolled in a program that grants a Bachelor or Master of Science degree. In the UAS sample, a similar level of inspection is not possible.

example, if a university student graduates within the desired five years, this allows for a potential maximum of around five years of labour market experience after tertiary education. However, as higher education studies often prolong beyond the desired finishing time in Finland, it is likely that most individuals of the sample have around two to three years of post-tertiary education labour market experience. Therefore, this follow-up time-period of ten years after starting their first degree is chosen because it allows one to look at earnings and employment in the early stages of graduates' working lives while also allowing the individuals to become somewhat established in the labour market. By focusing on earnings and employment at the beginning of graduates' careers, it reduces the exposure on labour market outcomes of graduating from different HEIs and degree programs from becoming substantially distorted by noise. Past empirical studies use similar follow-up time-periods based on the same rationale in order to grasp better the "added value" of human capital measured in terms of earnings or employment from different HEIs and field of study choices (see, e.g., Eliasson, 2006; Belfield et al., 2018).

After combining the datasets and excluding those observations with missing values regarding information about graduates' HEIs, fields of study, matriculation examination grades and other essential background characteristics, in total, there are 27,044 observations in the university sample and 18,490 observations in the UAS sample. Tables 1 and 2 present the number of observations in the final samples for each HEI, field of study and field of study-institution combination used in the analysis.

Table 1: Sample sizes for university graduates

	All	Business	Humanities	Social sciences	Technology
Aalto University	4675	1415	0	0	3260
University of Helsinki	2663	0	1463	1200	0
University of Eastern Finland	1399	108	579	712	0
University of Jyväskylä	2291	592	1023	676	0
University of Lapland	446	0	0	446	0
Lappeenranta University of Technology (LUT)	1675	415	0	0	1260
University of Oulu	2122	297	574	0	1251
Hanken School of Economics	940	940	0	0	0
Tampere University of Technology (TUT)	2896	0	0	0	2896
Tampere University	2230	466	661	1103	0
University of Turku	2782	1002	1088	617	75
University of Vaasa	1742	1037	415	162	128
Åbo Akademi University	1183	182	326	440	235
N	27044	6454	6129	5356	9105

Table 2: Samples sizes for UAS graduates

	All	Business	Humanities	Technology
Arcada University of Applied Sciences	321	205	0	116
Centria University of Applied Sciences	824	346	82	396
Diaconia University of Applied Sciences	124	0	124	0
Haaga-Helia University of Applied Sciences	907	907	0	0
Humak University of Applied Sciences	240	0	240	0
Häme University of Applied Sciences	1066	367	0	699
JAMK University of Applied Sciences	1011	537	0	474
South-Eastern Finland University of Applied Sciences	2084	787	471	826
Kajaani University of Applied Sciences	321	215	0	106
Karelia University of Applied Sciences	550	279	0	271
Lahti University of Applied Sciences	741	415	0	326
Lapland University of Applied Sciences	444	228	0	216
Laurea University of Applied Sciences	1148	1148	0	0
Metropolia University of Applied Sciences	690	242	0	448
Oulu University of Applied Sciences	1052	456	0	596
Saimaa University of Applied Sciences	627	319	0	308
Satakunta University of Applied Sciences	1344	783	0	561
Savonia University of Applied Sciences	1033	460	0	573
Seinäjoki University of Applied Sciences	780	529	0	251
Tampere University of Applied Sciences	572	513	0	59
Turku University of Applied Sciences	1495	643	0	852
Vaasa University of Applied Sciences	851	443	0	408
Novia University of Applied Sciences	265	42	85	138
N	18490	9864	1002	7624

Overall, the final samples include information on graduates from 13 universities, 23 UAS, four fields of study and 78 field of study-institution combinations.[21] Tables A1 and A2 in the Appendix show the universities and UAS included as well as further information of the different fields of study and degrees associated with each HEI in the analysis.

[21] The university and UAS names were identified by receiving permission from each HEI. The classification of different fields of study in HEIs is based on the government decrees on universities and UAS.

4.3 Variable definitions

The identification strategy used in this paper requires to observe variables that affect both the treatment (the higher education choice) and the outcome (earnings and employment) as higher education choices are not randomly assigned. Failure to include enough controls or the right controls does not diminish the impact of selection bias (Angrist and Pischke, 2015, p. 69). Principally, in regression analysis, it is essential to use only control variables that are determined before the actual higher education choice. Variables that are determined after the higher education choice can be themselves potential outcome variables in the experiment at hand and, therefore, adding these bad controls can bias the estimates in focus (Angrist and Pischke, 2008, p. 47). Due to these reasons and with the help of economic theory and the methods used in previous empirical research, this study combines a data set that includes (1) essential individual information such as gender, mother tongue, and high school region; (2) grades in matriculation examination (the highest grade in first language and basic/advanced math); (3) information about the identity of the degree awarding HEIs and the field of study. All of these independent variables indicate the situation before the individuals enrol in higher education. When examining higher education choices and their returns, detailed information about graduates' pre-higher education characteristics, most notably matriculation examination grades and high school region is valuable. They are important predictors for a student's HEI and field of study choice and, hence, work as essential control variables throughout the examination of the results.[22]

In particular, previous empirical literature points out that school grades obtained before the enrolment into higher education influence not only earnings but also higher education choices (Öckert, 2010; Lang and Siniver, 2011). For instance, students with higher grades might be expected to earn more regardless of where they go to study. Adding school grades as a control variable can consequently diminish some of the selection bias. Especially, introducing matriculation grades in the Finnish context are essential as they serve as a good indicator for academic ability. As presented in the institutional setting section, almost all Finnish upper secondary students participate in a standardised examination which provides general qualification to apply for universities and UAS.[23] This study uses

[22]Using the socio-economic background of graduates as a control variable would also be desirable in the current analysis as it is often used in the previous empirical literature that employs a similar regression-based method. The information about the socio-economic background of graduates is not, however, available with the data at hand.

[23]Admission to universities and UAS is generally dependent on a subject and degree specific entrance examination, matriculation examination grades and high school grades. Some programs can accept students directly with good matriculation examination grades without having to take part in an entrance exam.

matriculation examination grades as a convincing variable for academic ability because it is a standardised test that has a central role in the higher education admissions and individuals consider it effectively as an exam with high stakes. Furthermore, all upper secondary school students take the exam regardless of whether they intend to apply for tertiary education or not. Therefore, the actual exam does not suffer from selection bias.

The main dependent variable used in this paper is the measure of yearly earnings which is obtained from the FOLK income data module. Earnings include both wage and entrepreneurial income before taxes. These do not include social transfers paid or capital income which are not good indicators to measure productivity or labour market success resulting from attending a certain HEI or field of study. Using the sum of wage and entrepreneurial income solely allows measuring more precisely the human capital accumulation of different degrees.[24] The dependent earnings variable includes all figures even those with zero income and those who are not in employment as this can also be a direct result of higher education choices.[25] However, individuals with missing yearly earnings are excluded from the samples. This does not affect the main results because the share of these observations is insignificant. Finally, to guarantee comparability between years, the measure of income is adjusted to 2016 price and wage level using the consumer price index (Statistics Finland, 2017b).

In addition, the second dependent variable used in this study examines the employment prospects of graduates. Specially, this dependent variable model the probability of individuals from different HEIs and fields of study to be in employment or self-employment compared to be unemployed or not in the workforce. Similarly, as with earnings, these employment probabilities are examined ten years after the individuals have enrolled in their first HEI degree programs.

Table 3 introduces a comprehensive description of the variables used in the analyses of this thesis.

[24]Yearly earnings consist of both hourly wages and working hours, implying that the outcome is a combination of both productivity and labour supply choices.

[25]The number of observations with zero earnings is small for both genders in both samples.

Table 3: Variable definitions

Variable	**Definition**
Dependent variables	
Total annual earnings (€)	Total annual (gross) earnings from employment and self-employment. Adjusted to 2016 price and wage level using the consumer price index.
Probability of being in employment (%)	The probability of being in employment or self-employment compared to being unemployed or not in the workforce. Those who are not in the workforce include those individuals who are studying or who are outside the workforce for other reasons.
Independent variables	
Background characteristics	
Women	Takes a value of 1 if a woman and 0 otherwise.
Swedish speaker	Takes a value of 1 if the individual's mother tongue is Swedish and 0 otherwise.
High school region	The municipality where the individual completed a high school degree. Includes 289 categories.
Measurement year	The measurement year of earnings and employment figures. Includes 17 categories from the year 2000 to 2016.

Table 3: *Continued*

Variable	Definition
Matriculation examination grades	
Matriculation grade in first language	The highest grade obtained in the first language test of the Finnish Matriculation examination test. The variable includes seven categories (beginning from the lowest category): improbatur (I); approbatur (A); lubenter approbatur (B); cum laude approbatur (C); magna cum laude approbatur (M); eximia cum laude approbator (E); laudatur (L).
Matriculation grade in mathematics	The highest grade obtained in the mathematics test of the Finnish matriculation examination. This variable includes 15 categories (beginning from the lowest category): no maths; basic level improbatur (I); basic level approbatur (A); basic level lubenter approbatur (B); basic level cum laude approbatur (C); basic level magna cum laude approbatur (M); basic level eximia cum laude approbator (E); basic level laudatur (L); advanced level improbatur (I); advanced level approbatur (A); advanced level lubenter approbatur (B); advanced level cum laude approbatur (C); advanced level magna cum laude approbatur (M); advanced level eximia cum laude approbator (E); advanced level laudatur (L).
Higher education characteristics	
HEI	The HEI the individual enrolled for his/her first higher education degree. This variable includes 13 categories in the university sample and 23 categories in the UAS sample. See Table A1 in the Appendix to see the full list of the university and UAS names used in the analysis.

Table 3: *Continued*

Variable	Definition
Field of study	The field of study the individual enrolled for his/her first degree. This variable includes four categories in the university sample: business; humanities; social sciences; technology and three categories in the UAS sample: business; humanities; technology.
Degree	This variable is only used in the university sample. The name of the degree granted by the university. This variable includes eight categories; Bachelor of Arts (Humanities); Master of Arts (Humanities); Bachelor of Social Sciences; Master of Social Sciences; Bachelor of Science in Technology; Master of Science in Technology; Bachelor of Science (Economics and Business Administration); Master of Science (Economics and Business Administration).

4.4 Descriptive statistics

To get a better idea of the labour market outcomes of the university and UAS graduates, Tables 4 and 5 reports the basic descriptive statistics by HEIs of the two samples at hand. In these tables, the individuals are categorised by different HEIs, and the means of the selected variables are reported. These tables illustrate the need to account for several background as well as field of study characteristics of graduates when attempting to establish the relationship between different higher education choices and labour market outcomes.

From Tables 4 and 5, it is apparent that in both samples there exists a variation in the average earnings between graduates from different HEIs ten years after they had first enrolled in higher education. In the university sample, graduates from Aalto University and Hanken School of Economics have on average the highest earnings, as they earn approximately €42,000 and €45,000 per year, respectively. Graduates from the University of Helsinki and the University of Eastern Finland, on the other hand, have the lowest average earnings with earnings around €26,000 per year. In the UAS sample, graduates from Arcada and Metropolia have the highest earnings with around €40,000 per year for both institutions whereas the lowest average earnings are approximately €22,000 per year for graduates from Humak. Furthermore, in both samples, women have lower average earnings per year in all of the institutions compared to men. For example, when examining the sample averages of both samples, women's average earnings per year are notably over €11,000 lower than those of men. Moreover, the percentages for those who are employed are high, well above 80%, in most of the HEIs as well as for both genders. Therefore, the samples appear to be in line with previous literature that acknowledges the relatively high employment figures of higher education graduates in Finland. Interestingly, it is also clear from Tables 4 and 5 that there exist some differences between the types of individuals in different HEIs when delving into the matriculation examination grades and the composition of different fields of study associated with each HEI of the samples. For instance, the University of Helsinki has humanities and social science graduates incorporated in the sample, and they have the highest average matriculation grades in the first language. Graduates from Aalto University, instead, have the highest advanced math grades and are from the fields of business and technology.

Table 4: Means of selected variables for university graduates

	Whole Sample	Aalto University	University of Helsinki	University of Eastern Finland	University of Jyväskylä	University of Lapland	LUT	University of Oulu	Hanken School of Economics	TUT	Tampere University	University of Turku	University of Vaasa	Åbo Akademi University
Average annual earnings (€)	33,976	41,956	26,265	26,433	29,184	27,433	38,798	32,877	44,787	37,025	30,019	31,081	36,574	29,998
For men	39,511	43,641	29,019	31,387	36,182	34,091	40,436	36,764	51,302	38,026	38,105	39,745	43,449	34,402
For women	28,445	37,909	25,252	24,137	26,254	25,383	34,534	26,190	36,069	33,036	26,686	26,766	30,682	26,862
Employed	0.84	0.89	0.80	0.79	0.82	0.81	0.87	0.81	0.90	0.86	0.83	0.82	0.88	0.84
For men	0.86	0.89	0.82	0.81	0.86	0.74	0.88	0.83	0.91	0.86	0.84	0.85	0.90	0.85
For women	0.82	0.89	0.80	0.78	0.81	0.83	0.85	0.78	0.90	0.86	0.82	0.80	0.86	0.84
Women	0.50	0.29	0.73	0.68	0.70	0.76	0.28	0.37	0.43	0.20	0.71	0.67	0.54	0.58
Age at measurement year	30.26	29.69	30.67	30.56	30.71	31.27	30.22	29.99	30.33	29.65	30.73	30.53	30.67	29.86
Swedish speaker	0.09	0.04	0.09	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.03	0.83
Matriculation grade in first language	3.94	3.88	4.40	3.99	4.25	3.80	3.39	3.72	3.55	3.59	4.22	4.22	3.83	3.90
Matriculation grade in A-maths	3.66	4.19	3.38	2.93	3.18	2.51	3.38	3.51	2.98	4.00	3.29	3.43	2.97	3.13
Math test taken at A-level	0.57	0.89	0.33	0.29	0.37	0.26	0.80	0.72	0.43	0.93	0.34	0.42	0.42	0.38
Matriculation grade in B-maths	3.82	4.33	3.85	3.53	3.81	3.57	3.92	3.73	3.63	4.16	3.84	3.99	3.65	3.58
No math grade	0.12	0.01	0.26	0.24	0.17	0.24	0.02	0.08	0.08	0.00	0.19	0.17	0.13	0.20
Field of study														
Business	0.24	0.30	0.00	0.08	0.26	0.00	0.25	0.14	1.00	0.00	0.21	0.36	0.60	0.15
Humanities	0.23	0.00	0.55	0.41	0.45	0.00	0.00	0.27	0.00	0.00	0.30	0.39	0.24	0.28
Social Sciences	0.20	0.00	0.45	0.51	0.30	1.00	0.00	0.00	0.00	0.00	0.49	0.22	0.09	0.37
Technology	0.34	0.70	0.00	0.00	0.00	0.00	0.75	0.59	0.00	1.00	0.00	0.03	0.07	0.20
N	27044	4675	2663	1399	2291	446	1675	2122	940	2896	2230	2782	1742	1183

Notes: The following numeric values were assigned for calculating the average matriculation grades: A=1; B=2; C=3; M=4; E or L=5.

Table 5: Means of selected variables for UAS graduates

	Whole Sample	Arcada	Centria	Diaconia	Haaga-Helia	Humak	Häme	JAMK	South-Eastern Finland	Kajaani	Karelia	Lahti	Lapland	Laurea	Metropolia
Average annual earnings (€)	33,367	39,931	28,947	27,614	37,506	22,427	34,883	34,308	31,627	29,549	31,855	34,256	34,207	34,917	40,432
For men	39,976	45,661	35,706	32,732	51,219	29,114	40,671	40,090	38,737	36,557	35,630	40,529	39,071	45,006	46,352
For women	26,924	32,135	21,713	26,688	33,063	20,926	28,105	27,732	25,119	23,246	25,926	29,164	28,242	28,852	30,544
Employed	0.89	0.89	0.85	0.83	0.89	0.80	0.89	0.89	0.86	0.85	0.86	0.90	0.89	0.92	0.91
For men	0.90	0.92	0.87	0.89	0.91	0.84	0.91	0.90	0.89	0.81	0.86	0.93	0.91	0.94	0.94
For women	0.87	0.85	0.84	0.82	0.89	0.80	0.88	0.88	0.84	0.88	0.87	0.89	0.87	0.90	0.87
Women	0.51	0.42	0.48	0.85	0.76	0.82	0.46	0.47	0.52	0.53	0.39	0.55	0.45	0.62	0.38
Age at measurement year	31.11	30.86	30.69	31.30	32.40	31.63	31.08	30.95	31.01	30.80	30.84	31.16	31.86	31.32	31.96
Swedish speaker	0.04	0.80	0.05	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Matriculation grade in first language	3.13	2.92	2.93	3.91	3.73	3.67	3.13	3.28	3.09	3.01	2.97	3.13	3.01	3.08	3.14
Matriculation grade in A-maths	2.45	2.39	2.29	2.50	2.73	2.48	2.50	2.60	2.44	2.33	2.29	2.74	2.17	2.17	2.60
Math test taken at A-level	0.33	0.26	0.26	0.16	0.23	0.13	0.38	0.52	0.28	0.29	0.32	0.30	0.30	0.18	0.50
Matriculation grade in B-maths	3.21	2.99	2.91	2.98	3.29	3.06	3.33	3.48	3.17	3.08	3.35	3.33	3.00	3.04	3.39
No math grade	0.15	0.17	0.16	0.35	0.22	0.37	0.09	0.08	0.19	0.19	0.15	0.18	0.17	0.26	0.12
Field of study															
Business	0.53	0.64	0.42	0.00	1.00	0.00	0.34	0.53	0.38	0.67	0.51	0.56	0.51	1.00	0.35
Humanities	0.05	0.00	0.10	1.00	0.00	1.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00
Technology	0.41	0.36	0.48	0.00	0.00	0.00	0.66	0.47	0.40	0.33	0.49	0.44	0.49	0.00	0.65
N	18490	321	824	124	907	240	1066	1011	2084	321	550	741	444	1148	690

Table 5: *Continued*

	Oulu	Saimaa	Satakunta	Savonia	Seinäjoki	Tampere	Turku	Vaasa	Novia
Average annual earnings (€)	33,258	34,335	33,210	32,850	31,604	26,788	34,447	34,409	31,329
For men	38,902	41,910	40,328	38,579	38,485	29,062	39,658	40,019	38,940
For women	25,649	25,700	26,341	24,654	26,119	25,951	27,113	27,684	21,313
Employed	0.87	0.87	0.90	0.89	0.89	0.86	0.89	0.90	0.89
For men	0.89	0.90	0.93	0.89	0.92	0.81	0.91	0.91	0.94
For women	0.84	0.84	0.88	0.89	0.86	0.88	0.86	0.89	0.82
Women	0.43	0.47	0.51	0.41	0.56	0.73	0.42	0.45	0.43
Age at measurement year	30.87	30.98	30.80	30.93	30.67	31.22	31.03	30.96	31.30
Swedish speaker	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.14	0.84
Matriculation grade in first language	3.15	3.11	2.97	3.02	3.02	3.24	3.11	3.04	3.12
Matriculation grade in A-maths	2.40	2.28	2.28	2.35	2.37	2.45	2.59	2.34	2.43
Math test taken at A-level	0.43	0.44	0.29	0.38	0.26	0.19	0.42	0.32	0.23
Matriculation grade in B-maths	3.35	3.27	3.20	3.19	3.05	3.00	3.45	3.08	3.11
No math grade	0.08	0.11	0.14	0.14	0.16	0.24	0.08	0.13	0.18
Field of study									
Business	0.43	0.51	0.58	0.45	0.68	0.90	0.43	0.52	0.16
Humanities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32
Technology	0.57	0.49	0.42	0.55	0.32	0.10	0.57	0.48	0.52
N	1052	627	1344	1033	780	572	1495	851	265

Notes: The following numeric values were assigned for calculating the average matriculation grades: A=1; B=2; C=3; M=4; E or L=5.

Figures 1 and 3 graphically present the boxplot figures for the distribution of earnings by universities and UAS.[26] Figures 2 and 4 then display the distribution of earnings by gender. These boxplot figures give an overall picture of the distribution of earnings between graduates that average earnings figures might otherwise hide. They illustrate the difference in earnings by HEIs as well as the apparent earnings differences between genders within the same institutions.[27]

[26] The boxplot figures presented in this chapter indicate how earnings are spread out through their quartiles. For example, the band inside the box is the second quartile which is the median (50^{th} percentile, i.e. the middle value). Minimum and maximum values are excluded in these boxplot figures.

[27] When interpreting the earnings distributions by gender, it is important to acknowledge that some women in the sample who are categorised as employed might be on maternity leave.

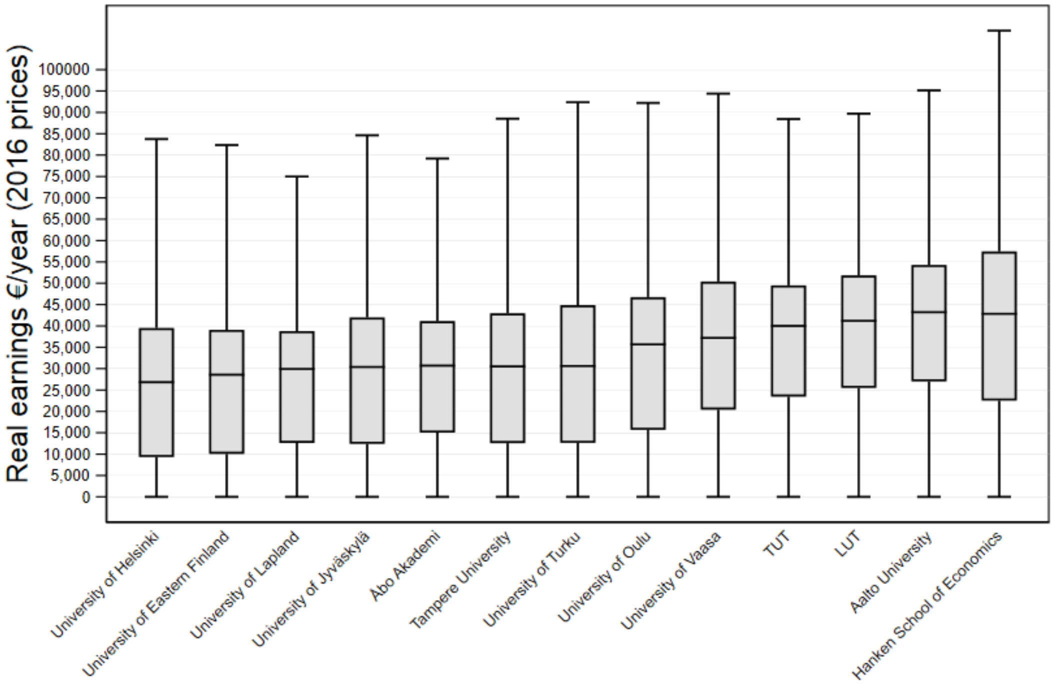

Figure 1: Boxplot of real earnings by university

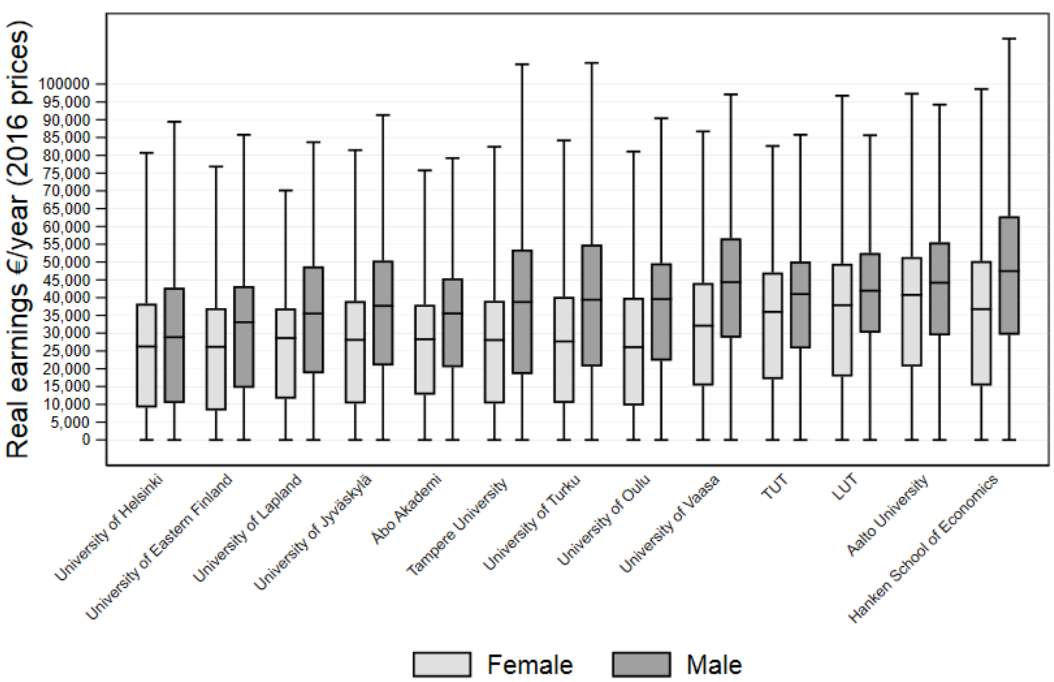

Figure 2: Boxplot of real earnings by university and gender

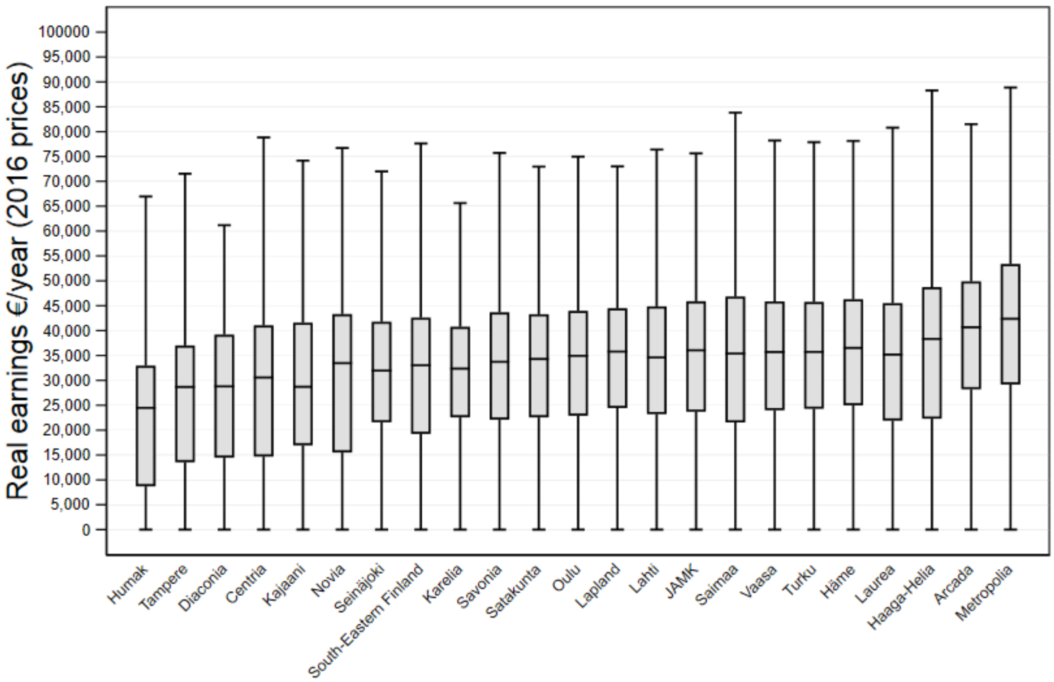

Figure 3: Boxplot of real earnings by UAS

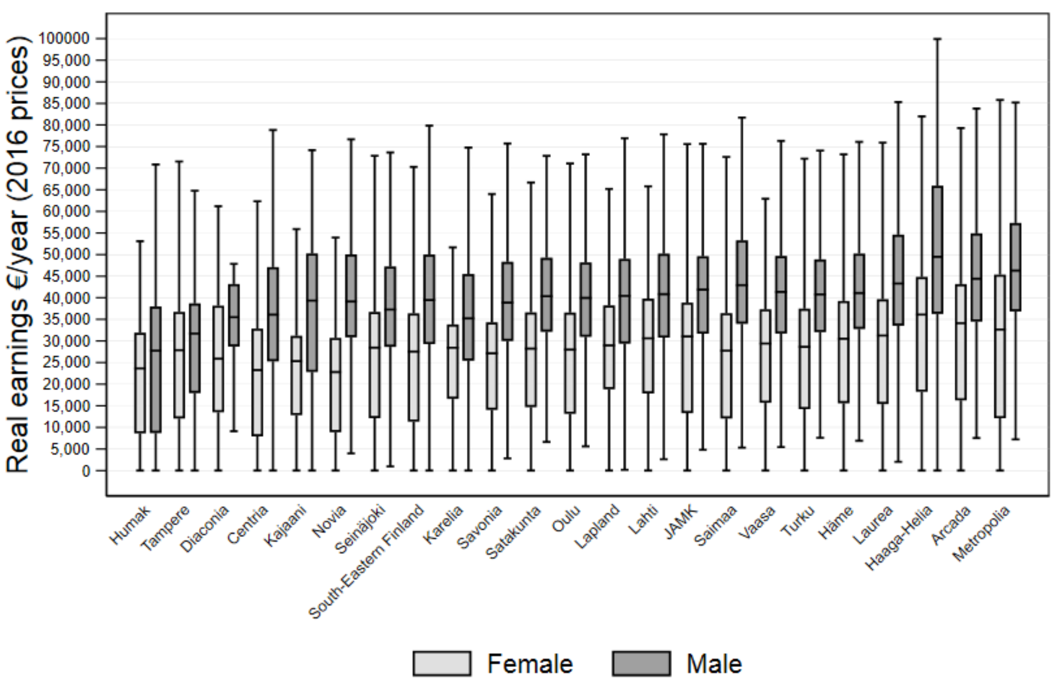

Figure 4: Boxplot of real earnings by UAS and gender

Tables 6 and 7 continue to show the average earnings per year for graduates from different fields of study. Furthermore, these tables also allow for the examination of the average earnings per year for field of study – institution combinations for both samples. Initially, the tables show that there are average earnings differences across the different fields of study used in the analysis which is in accordance with previous results found in Finland and, in general, in the Nordics (see, e.g., Kirkeboen et al., 2016; Suhonen and Jokinen, 2018). In the university sample, those who studied business and technology have average earnings of approximately €43,000 and €38,000 per year whereas social science and humanities graduates earn around €29,000 and €23,000 per year, respectively. The UAS sample presents a very similar picture. The average earnings are highest with those who studied technology, with €37,000 per year. Those who studied business earn on average €31,000 per year while those who studied humanities receive the least with around €23,000 per year. Interestingly, there is considerable variation between genders when examining the average earnings within the different fields of study. For instance, the most significant variation in earnings in both samples is in the field of business. Women's average earnings are around €13,000 per year lower than those of men. The tables also reveal variation in the average earnings between HEIs within the same fields of study in both samples. For instance, those graduates who studied technology in Metropolia earn on average €41,000 per year whereas those individuals who studied the same field in Centria earn less, around €33,000 per year.

Table 6: Average earnings per year (€) by university and field of study

	Business	Humanities	Social sciences	Technology
Aalto University	48,269	0	0	39,216
University of Helsinki	0	22,609	30,723	0
University of Eastern Finland	37,519	21,983	28,369	0
University of Jyväskylä	39,810	24,623	26,780	0
University of Lapland	0	0	27,433	0
Lappeenranta University of Technology (LUT)	41,317	0	0	37,968
University of Oulu	37,829	21,361	0	36,986
Hanken School of Economics	44,787	0	0	0
Tampere University of Technology (TUT)	0	0	0	37,025
Tampere University	42,472	21,827	29,667	0
University of Turku	43,023	21,160	28,567	36,158
University of Vaasa	41,811	24,489	33,362	37,395
Åbo Akademi University	39,883	24,237	27,373	35,250
Field of study average earnings				
Whole sample	43,371	22,641	28,977	37,887
Men	49,534	23,465	33,935	38,847
Women	36,617	22,429	26,901	33,989

Table 7: Average earnings per year (€) by UAS and field of study

	Business	Humanities	Technology
Arcada University of Applied Sciences	37,366	0	44,463
Centria University of Applied Sciences	26,445	19,713	33,046
Diaconia University of Applied Sciences	0	27,614	0
Haaga-Helia University of Applied Sciences	37,506	0	0
Humak University of Applied Sciences	0	22,427	0
Häme University of Applied Sciences	29,275	0	37,827
JAMK University of Applied Sciences	31,186	0	37,846
South-Eastern Finland University of Applied Sciences	30,082	22,649	38,219
Kajaani University of Applied Sciences	26,630	0	35,470
Karelia University of Applied Sciences	29,552	0	34,225
Lahti University of Applied Sciences	35,099	0	33,183
Lapland University of Applied Sciences	31,171	0	37,397
Laurea University of Applied Sciences	34,917	0	0
Metropolia University of Applied Sciences	38,726	0	41,350
Oulu University of Applied Sciences	29,907	0	35,823
Saimaa University of Applied Sciences	29,127	0	39,729
Satakunta University of Applied Sciences	29,485	0	38,409
Savonia University of Applied Sciences	27,327	0	37,284
Seinäjoki University of Applied Sciences	29,396	0	36,258
Tampere University of Applied Sciences	26,690	0	27,645
Turku University of Applied Sciences	31,398	0	36,749
Vaasa University of Applied Sciences	30,109	0	39,078
Novia University of Applied Sciences	29,545	18,265	39,980
Field of study average earnings			
Whole sample	31,393	22,598	37,336
Men	40,467	27,601	40,218
Women	27,366	21,065	27,761

Figures 5, 6, 7 and 8 graphically present the numbers from the Tables 6 and 7 using boxplot figures. These figures also illustrate the earnings differences by gender within different fields of study.

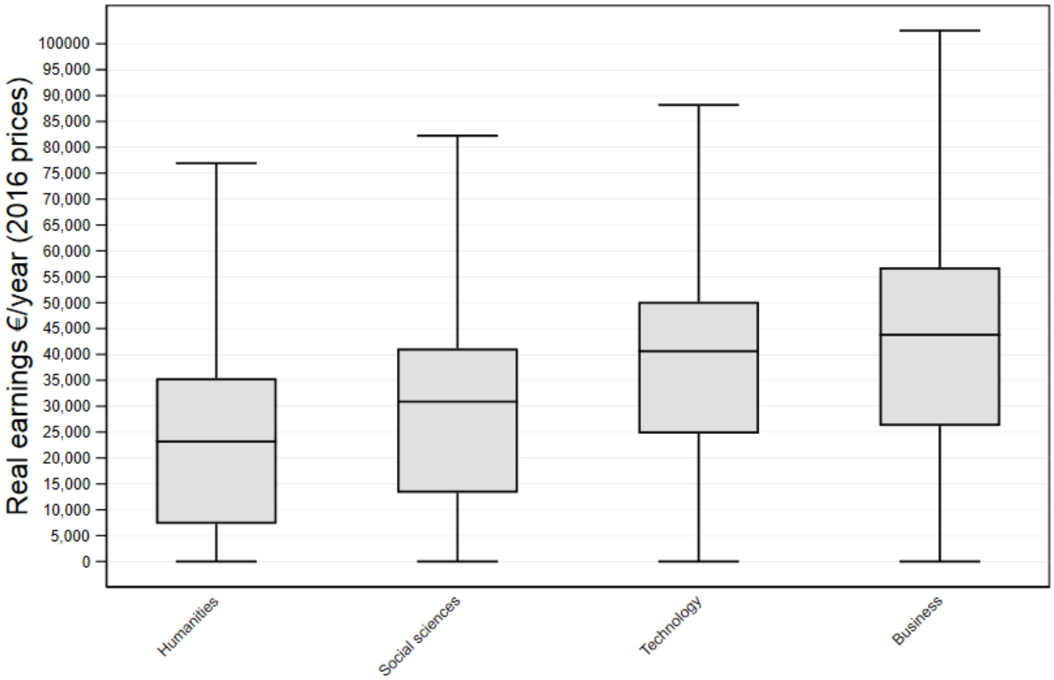

Figure 5: Boxplot of real earnings by university field of study

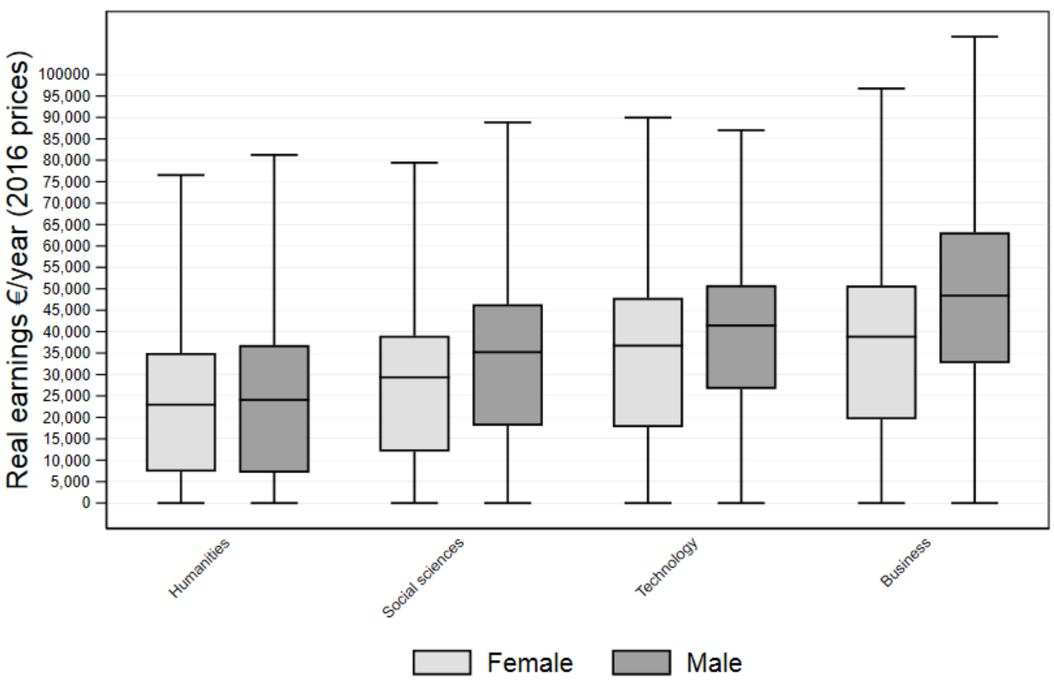

Figure 6: Boxplot of real earnings by university field of study and gender

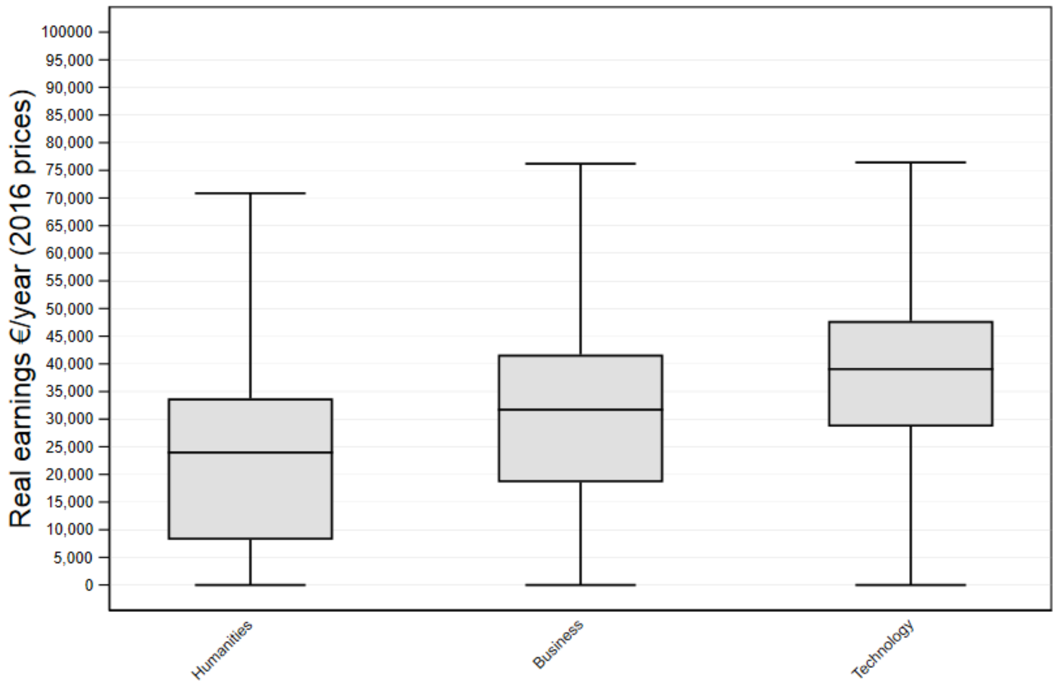

Figure 7: Boxplot of real earnings by UAS field of study

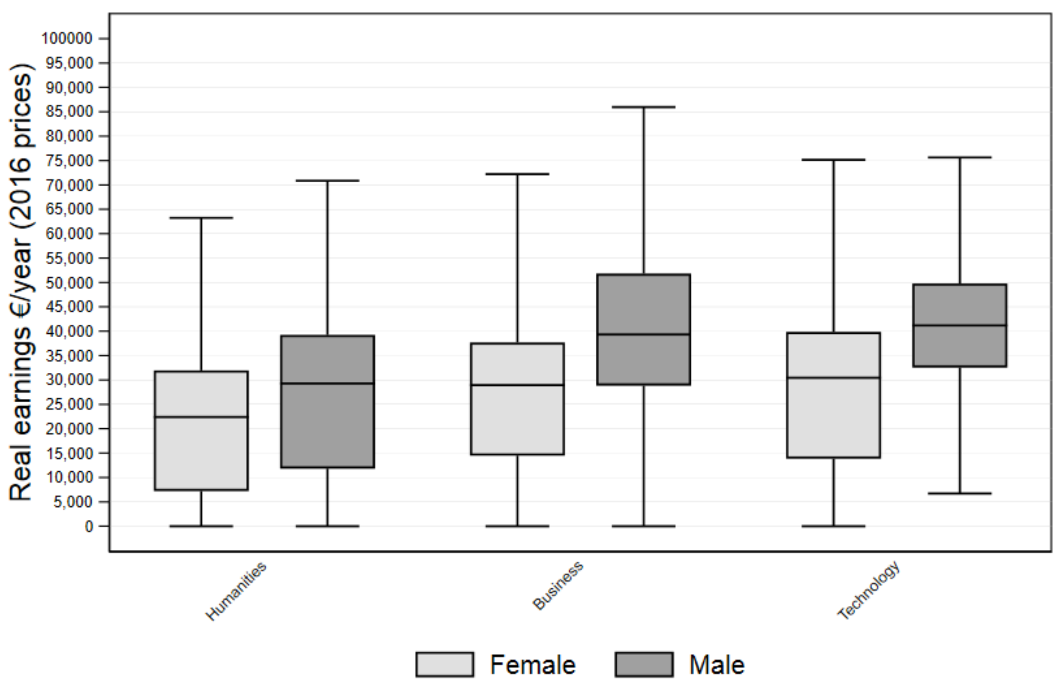

Figure 8: Boxplot of real earnings by UAS field of study and gender

Figures 9 and 10 graphically show the earnings distribution for the field of study-institution combinations for the university and UAS samples.[28] These figures are colour coded based on the field of study of the graduates.[29]

[28]These boxplot figures display the overall earnings distribution without exploring the differences by gender. This is because in some of the field of study-institution combinations the observations fall below 100 observations per gender.

[29]When interpreting the average earnings distributions for different field of study-institution combinations, the small sample sizes in some of the cases should be taken into account (see Tables 1 and 2).

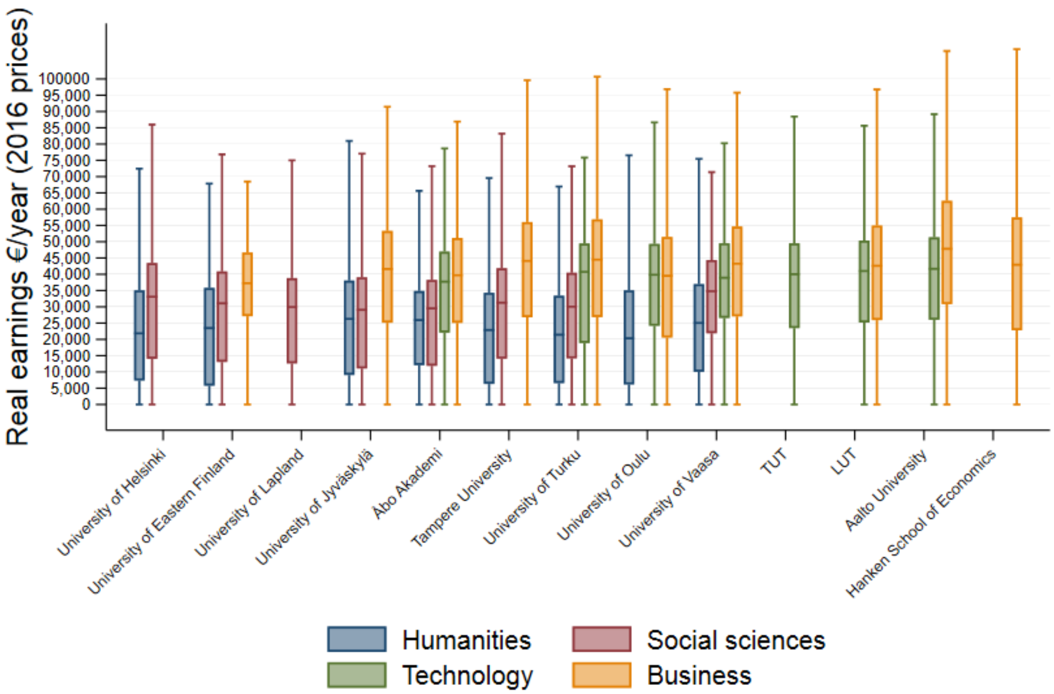

Figure 9: Boxplot of real earnings by university and field of study

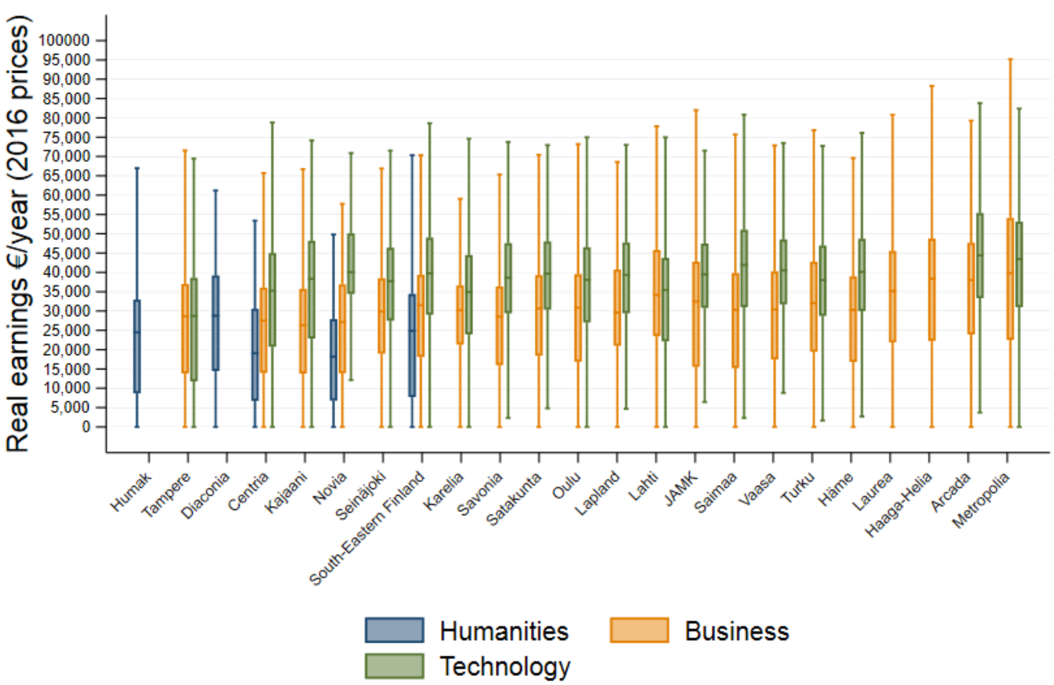

Figure 10: Boxplot of real earnings by UAS and field of study

Importantly, the differences in average earnings presented in this chapter between HEIs, fields of study and field of study-institution combinations can be partly due to the differences in the types of students enrolled in these institutions and study programs or the specific result of gaining the degree as such. The main contribution of this thesis is to attempt to alleviate some of the bias resulting from the differences in the observable student characteristics to reveal some of the human capital accumulation ability, in other words, the "added value" impact of different higher education choices.

5 Methodology

Next, I go through the details of the empirical models that address the research questions and provide the base for the empirical analysis. I follow a similar empirical approach to that of Belfield et al. (2018) in their paper. This section is divided into the model of earnings and the model of employment. I will end this section by presenting the limitations of the empirical methods employed.

5.1 Model of earnings

The following form linear OLS regression model (ordinary least squares) is employed to examine higher education choices and earnings:

$$Y_i = \alpha + \beta_1 H_i + \beta_2 F_i + \beta_3 C_i + \gamma X_i + \delta U_i + \varepsilon_i \tag{1}$$

where Y_i is the sum of annual work and entrepreneurial earnings for an individual i, ten years after first being enrolled in a university or a UAS degree program[30]; α is an intercept; H_i is a vector of indicators for having studied in a particular HEI; F_i is a vector of i's field of study choice; C_i is a vector of indicators for i's field of study-institution combination; X_i is a vector of i's pre-higher education characteristics; U_i is the measurement year of i's earnings, and $varepsilon_i$ is the error term. In this analysis, H, F, C are the variables of most interest. These variables are dummy variables, and they are all related to the higher education choices of the graduates. These variables are equal to 1 if it is the graduate's specific HEI, field of study and field of study-institution combination and 0 otherwise. A graduate can only be included in one higher education choice. The ordinary least squares (OLS) estimation method used in this study is based on the conditional independence assumption (CIA). This means that conditional on the observables incorporated in the model, graduating from a specific HEI, field of study and field of study-combination is assumed to be independent of the counterfactual outcomes, in other words, the potential earnings in the cases of $H_i = 1$ and $H_i = 0$ and $F_i = 1$ and $F_i = 0$ and $C_i = 1$ and C_i $= 0$. Several control variables are added in the model to increase the credibility of this assumption. Specifically, conditioning on a rich set of graduates' observable pre-higher

[30] These earnings figures have been inflation-adjusted using money value multipliers (Statistics Finland, 2017b).

education characteristics due to the non-random selection into higher education are included in vector X_i: gender, mother tongue, matriculation examination grades and high school region. In particular, as concluded by Eliasson (2006) and Suhonen (2013), matriculation examination grades and high school region are valuable control variables as these variables can cast restraints in i's higher education choice and seize some of the heterogeneity related to, for example, innate ability, motivation and ambition. The high school region variable especially controls for confounding bias related to the relationship between higher education choices and subsequent location. For example, after graduation an individual might want to live close to his or her pre-HEI region irrespective of the initial HEI selected. This could be because of family ties, individual's preferences or networks that are situated in the area that could potentially also have some indications for the individual's future earnings. Furthermore, as the samples consist of individuals at different points in time, the earnings measurement year fixed effect, U_i, controls for differences in earnings deriving from business cycles and other time-variant factors. Finally, the field of study choice is controlled when modelling the returns to HEI choices. Essentially, this avoids the differences in fields of study impacting the results, that is, to prevent the HEI estimates to be only dictated by the HEI solely offering high or low-return fields of study.

5.2 Model of employment

This study also examines the employment probabilities of graduates who studied in different HEIs and fields of study. With the available data at hand, employment includes those who are in salaried work as well as those who are self-employed. The model of employment measures the probability of being employed ten years after first being enrolled in a university or a UAS degree program. Both HEI and field of study estimates are examined. The model of employment follows the same equation as the model for earnings; however, the equation is estimated using a Linear Probability Model estimation:

$$Y_i = \alpha + \beta_1 H_i + \beta_2 F_i + \gamma X_i + \delta U_i + \varepsilon_i \tag{2}$$

Here the dependent variable, Y_i, for each individual takes the value 1 (employed) or 0 (not employed). The pre-higher education characteristics, as well as the HEI and field of study, are also incorporated in the estimation to control for the different field of study combinations associated with each HEI. The vectors β_1 and β_2 give the estimates of HEIs and fields of study on employment prospects of graduates.

5.3 Limitations

There are several potential threats to the validity of the analysis as the models make several crucial assumptions. Firstly, there is a strong assumption of the functional form of the models. That is, the models suggest that the individual traits in X_i have a linear impact on earnings end employment. However, this might be violated. Individual traits might also have non-linear effects or interactions between characteristics which might be vital for the model (Eliasson, 2006). This issue is often relevant when comparing different kinds of groups. When implementing a selection-on-observables approach, the literature proposes two main methods: regression or matching.[31] Specifically, the divergence between linear regression methods and matching methods arises as the former can hide the failure of the "common support" condition due to the linearity assumption and the latter is explicitly able to address this problem (Black and Smith, 2004). The following example illustrates this issue. Consider the case where individuals with high ability only graduate from predominately high-quality selective HEIs and low ability individuals solely graduate from low-quality HEIs. The counterfactual outcome – what high ability students experience when attending low-quality HEIs – is not non-parametrically identified in this case. The linear functional form assumption, instead, identifies the counterfactual outcome. In other words, it is impossible to determine the impact of HEIs on earnings without making arbitrary assumptions about the functional form of the relationship between earnings, HEI quality and ability. Matching estimators, on the other hand, usually resolve the "common support" issue by dropping observations without having adequate support, whereas traditional regression estimators produce comparability by casting linearity and extrapolating over areas of no support. However, the latter approach can be sensitive to imprecise functional form assumptions which can create extrapolation bias (Black and Smith, 2004; Eliasson, 2006). Matching can, nevertheless, be complicated in its application in comparison to regression and can be computationally intensive demanding judgement at several stages of the process which can distort the estimates and limit their precision (Black, 2015). Furthermore, when examining a multitude of treatment groups such as in this study, using a matching method as a solution to overcome problems related to regression models is

[31] Matching is a method that finds pairs of individuals who are observably very similar in the data apart from the fact that one individual goes to a different HEI compared to the other individual. Essentially, matching allows a way of estimation without implementing strong functional form assumptions that OLS makes (Black, 2015).

impractical in this context.

Secondly, as discussed throughout this paper, a problematic feature that arises with regression modelling of individuals' higher education choices and their payoffs is unobserved individual characteristics that may be correlated with both the explained and explanatory variables of the model which can bias estimates (Suhonen, 2015). Therefore, the validity of the conditional independence assumption implicated in OLS is jeopardised since individuals can be selected into HEIs and different degree programs partially on the grounds of unobserved earnings determinants that cannot be observed by the Register data used in this analysis. To emphasise the point in the context of the current study, several unobservable traits, such as non-cognitive skills as well as preferences for various kinds of work are not detected which can also impact earnings. Students, for instance, who study finance at Aalto University might initially have a stronger preference for work in the high paying finance sector. Ultimately, if these types of individual characteristics are consistently different between HEIs and fields of study they can potentially distort the estimates in a way that the estimates display the joint effect of the particular HEI choice and the systematic differences in unobservable characteristics (Belfield et al., 2018).

Thirdly, as Belfield et al. (2018) point out, the models also assume that the returns to specific higher education choices are homogenous, in other words, all types of different students can receive, on average, the same payoff from studying a particular higher education course.[32] This will still be the case if the differences in earnings are a result of differences in individuals' background characteristics. This is evidently a strong assumption as, for instance, an individual with a low math matriculation examination grade might benefit less from a technology degree as he or she could understand less of the material taught. Finally, the differences in graduates' earnings can reflect the variation in the demand for different skills sets in the labour market or differences in the actual quality of the different HEIs and degrees, or both. A specific course could be of superior quality but at the same time not provide the skills valued in the labour market at that particular time, and vice versa (Belfield et al., 2018). Therefore, earnings and employment figures cannot solely be used by themselves as a proxy for the quality of different HEIs and courses. Other factors and measures should also be taken into account in this context.

Due to the limitations mentioned above, caution should be exercised when interpreting

[32]The estimates are the weighted average of different effects if the effects of higher education choices are heterogeneous across students. Therefore, it would not inevitably be the overall Average Treatment Effect (effect across the whole population) or the Treatment Effect on the Treated (effect for those doing the specific higher education degree).

the findings of this study. Ultimately, the results of this paper are not to be interpreted as a causal effect of attending different HEIs, fields of study and field of study-institution combinations as individuals' higher education choices are inherently a non-random process. It is challenging to show the existence and magnitude of unobservables and whether they over or under estimate the results in non-random empirical approaches. A potential solution is to add more essential variables that can encapsulate some of the individual characteristics, such as, the matriculation examination grades of students used in this study. Adding more observed variables in the model can partly diminish some of the selection bias related to unobservables, for instance, if some of the unobservables such as motivation or ambition are correlated with matriculation grades. However, controlling for graduates' pre-higher education observable characteristics in the regression models used in this study will only alleviate some of this bias in the Finnish institutional setting. Therefore, it would require more sophisticated selection-on-unobservables methods to comprehensively account for the selection bias resulting from the non-random selection into HEIs.

At any rate, the justification for using OLS in the present study lies in its simple tactic, good estimate efficiency, and suitability to the dataset at hand. In addition, the descriptive statistics presented in this paper also play an essential role to provide valuable insights about possible causes and effects. Therefore, analysing the results from using OLS are more robust and holistically justified. Furthermore, a regression technique is preferred in this study because it is useful for carrying out a multidimensional analysis. For instance, running separate regressions and controlling for specific background characteristics allows for separate analysis for different groups.

6 Results and analysis

This section will present the results of the thesis based on the data and methodology introduced in the previous sections. The results are presented using a similar approach as in the paper by Belfield et al. (2018) which distinguish the empirical findings by three levels of analysis. I will report the regression-based estimates for HEIs, fields of study and field of study-institution combinations to examine the relationship between higher education choices and earnings.[33] The final section will also go through the estimates for the likelihood of gaining employment based on different higher education choices to give a more comprehensive picture of the labour market success of graduates in Finland.

6.1 Higher education institution estimates

I begin by presenting the regression-based estimates on the returns of attending different HEIs. These results include those graduates who enrolled in a university or a UAS degree program ten years before the earnings measurement year. The purpose of this section is also to illustrate how much of the variation in earnings between institutions is due to the difference in student intake as well as the different field of study mixes offered by different institutions. Tables 8 and 9 present the HEI estimates for university and UAS graduates respectively. In both tables, a particular HEI has been chosen as a reference category. The reference category was chosen on the basis that it represents approximately the sample average in question. Therefore, the reference category selected allows for the illustration of the variation of earnings compared to the approximation of the sample average. Column (1) presents the raw earnings differences per year by HEI in comparison to the chosen reference category. At the outset, the highest earning university graduates come from Aalto University and Hanken School of Economics whose earnings are on average around €10,900 and €13,700 more per year compared to graduates from the University of Turku. In the UAS sample, graduates from Arcada and Metropolia earn on average around €6,700 and €7,200 more per year than graduates from Satakunta. Column (2) then adds controls for graduates' background characteristics that are used in most earnings equations. They include controls for gender, mother tongue, high school region and the measurement year of earnings. Introducing these basic controls reduces the earnings differences in

[33]Due to the scope of this paper, this section will limit the analysis of the two samples without going into further detail regarding the gender-specific estimates. At any rate, these gender-specific estimates would also present an interesting line of enquiry based on the average earnings differences between genders illustrated in Section 4.

most of the HEI estimates. Column (3) subsequently adds controls for matriculation examination grades, which includes the highest grade obtained in the first language and basic or advanced maths tests. These controls further reduce the earnings differences in some of the estimates. This is typical because high-ability individuals can be expected to have higher earnings in the labour market irrespective of the institution they attend. For instance, after introducing controls for background characteristics and matriculation examination grades, the estimates for graduates from Aalto University have decreased almost by half, to a €5,400 difference per year compared to the reference category. Overall, adding matriculation grades as a control appears to have a more substantial influence in the university sample compared to the UAS sample. Finally, column (4), which is the preferred specification in both tables, adds controls for the field of study.[34] This is to account for the field of study mix offered by different HEIs. For example, education in high earning fields such as in business and technology might only be offered in certain HEIs whereas some HEIs might solely provide education in humanities. In essence, in this specification, no institution has an advantage or a disadvantage from offering a predominately high or low earning field of study. Overall, adding the field of study control appears to markedly reduce the variation in earnings in some of the institution estimates which is in agreement with previous literature (see, e.g. Kirkeboen et al., 2016). For example, the earnings differences between graduates from Aalto University and the reference category, University of Turku, has now been reduced to €3,700 per year.

Tables 8 and 9 show that the overall impact for controlling for several observable factors on different HEIs is considerable. For instance, the earnings difference between graduates from Metropolia reduced from €7,200 per year to €2,900 per year in comparison to graduates from Satakunta. This demonstrates that graduates' observable factors can explain some of the earnings differences between institutions. Importantly, however, even after controlling several observable factors there remain some differences in earnings from graduating from different HEIs. In the university sample, the graduate earnings differentials vary in the scope of €4,100 per year and in the UAS sample around €7,900 per year between the HEIs. An exception is Diaconia, which has the highest estimate in the UAS sample, and is not incorporated in this range.[35] Overall, examining the preferred specification also reveals that only a few of the HEI estimates are statistically significant.

[34] In the university sample, it is possible to control for the exact granted degree program which allows for the capture of more of the earnings variation related to graduates' field of study choices.

[35] A potential explanation for Diaconia's high estimate is that a high proportion are female (85%) in the institution's sample. In addition, the sample only has individuals who studied humanities. As females and those who studied humanities earn the least in the UAS sample, controlling for background characteristics as well as for the field of study results in a somewhat deviant estimate.

Table 8: University estimates (in euros)

	(1)	(2)	(3)	(4)
Aalto University	10874.9***	7823.9***	5411.9***	3698.6***
	(577.8)	(654.7)	(689.1)	(778.9)
University of Helsinki	-4816.1***	-4066.5***	-3642.0***	476.3
	(572.1)	(649.1)	(646.0)	(630.9)
University of Eastern Finland	-4648.7***	-3652.6***	-2595.2***	-244.2
	(658.5)	(734.6)	(735.7)	(720.7)
University of Jyväskylä	-1897.6***	-843.3	-408.8	445.5
	(608.9)	(661.6)	(655.8)	(638.8)
University of Lapland	-3648.5***	-2694.4**	-1643.7	-378.1
	(971.2)	(1116.3)	(1119.3)	(1134.3)
LUT	7716.3***	5887.5***	4997.0***	3208.9***
	(689.2)	(781.0)	(797.0)	(869.6)
University of Oulu	1795.9***	1302.0	715.1	939.7
	(642.0)	(791.5)	(792.3)	(806.0)
Hanken School of Economics	13706.0***	10199.1***	9695.2***	2284.8
	(1277.8)	(1361.7)	(1356.2)	(1395.8)
TUT	5943.5***	3884.4***	1941.4***	1970.6**
	(598.1)	(666.4)	(690.2)	(812.6)
Tampere University	-1062.0*	-464.3	-39.44	979.9
	(626.6)	(653.5)	(648.3)	(631.1)
University of Vaasa	5493.1***	4998.5***	5264.4***	1912.7***
	(703.8)	(744.5)	(741.6)	(736.1)
Åbo Akademi University	-1083.3	-388.3	-146.6	182.6
	(753.4)	(1047.6)	(1039.0)	(1020.3)
University of Turku	omitted (reference category)			
N	27044	27044	26919	26919
Adj. R-sq	0.058	0.097	0.104	0.135
Background characteristics	NO	YES	YES	YES
ME grades	NO	NO	YES	YES
Field of study	NO	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. Field of study controls include the four fields of study used in the university sample.

Table 9: UAS estimates (in euros)

	(1)	(2)	(3)	(4)
Arcada	6720.7***	5113.2***	4968.7***	4978.6***
	(1404.8)	(1898.6)	(1906.9)	(1903.3)
Centria	-4262.8***	-3347.9***	-3304.9***	-2384.8**
	(804.1)	(1016.5)	(1018.1)	(1019.8)
Diaconia	-5595.3***	14.82	297.7	8331.0***
	(1660.1)	(1715.6)	(1726.9)	(1868.5)
Haaga-Helia	4296.6***	5630.4***	5487.7***	5491.1***
	(985.8)	(1094.8)	(1094.7)	(1093.4)
Humak	-10783.0***	-5541.9***	-5138.7***	2971.6**
	(1198.9)	(1294.5)	(1290.9)	(1476.0)
Häme	1673.3**	1159.5	960.2	761.1
	(758.9)	(901.7)	(903.6)	(907.3)
JAMK	1098.7	1633.1*	1240.7	1437.9
	(764.9)	(944.3)	(948.7)	(947.7)
South-Eastern Finland	-1582.5**	-885.5	-792.5	1431.0*
	(642.6)	(840.2)	(840.9)	(868.1)
Kajaani	-3661.1***	-2824.6**	-2512.1*	-2411.8*
	(1158.0)	(1356.0)	(1358.7)	(1355.9)
Karelia	-1355.2	-1838.4	-1911.5	-1962.6
	(912.1)	(1255.7)	(1252.5)	(1255.1)
Lahti	1046.3	1929.9*	1906.1*	1905.6*
	(848.0)	(1042.9)	(1044.8)	(1045.5)
Lapland	997.1	-1464.1	-1347.2	-1300.4
	(974.3)	(1314.1)	(1316.0)	(1314.7)
Laurea	1706.9**	3118.4***	3214.7***	3296.9***
	(801.9)	(991.2)	(992.6)	(993.1)
Metropolia	7222.6***	3531.8***	3103.8***	2914.1***
	(936.1)	(1106.1)	(1115.5)	(1118.9)
Oulu	48.47	268.3	-25.65	-23.52
	(754.3)	(1068.9)	(1069.9)	(1068.8)
Saimaa	1125.1	909.8	597.0	681.5
	(921.7)	(1160.9)	(1160.7)	(1157.5)
Savonia	-359.7	-801.6	-874.4	-786.5
	(738.1)	(980.0)	(980.4)	(980.8)
Seinäjoki	-1605.4*	287.3	421.4	509.1
	(823.6)	(994.0)	(993.4)	(991.6)
Tampere	-6421.4***	-2066.9**	-1886.6*	-1894.3*
	(863.7)	(1017.4)	(1015.1)	(1011.9)
Turku	1237.6*	153.3	-144.6	-243.1
	(681.0)	(815.1)	(818.4)	(820.4)
Vaasa	1199.4	1655.7*	1629.1*	1759.3*
	(810.4)	(993.2)	(989.7)	(987.4)
Novia	-1881.1	-2416.6	-2564.3*	306.2
	(1221.7)	(1544.4)	(1530.3)	(1522.9)
Satakunta	omitted reference category			
N	18490	18490	18388	18388
Adj. R-sq	0.022	0.140	0.143	0.148
Background characteristics	NO	YES	YES	YES
ME grades	NO	NO	YES	YES
Field of study	NO	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. Field of study controls include the three fields of study used in the UAS sample.

For direct comparisons, Figures 11 and 12 display graphically the raw average earnings and the preferred specification estimates for each university. The figures show graduates' real earnings per year between different universities and include 95% confidence intervals.[36] The dashed line in these figures show the average earnings of all individuals in the university sample which is €33,976 per year. At the outset, in Figure 11, there appears to be significant variation in graduate earnings between universities. Universities with business and technology degrees in their course offerings are on the top of the earnings distribution whereas universities with more humanities degrees are on the bottom half of earnings distribution. Figure 12 then adds all the controls to account for observable differences. Figure 12 clearly illustrates that when controlling for student composition as well as for the field of study choices the estimated returns from initially high-earning universities is considerably reduced and the returns between different universities converge. This reflects the fact that these higher earning universities and fields of study attract students with a higher earnings potential. However, even after conditioning for background characteristics, initial academic ability and field of study there remain some earnings differences between universities. For example, Aalto University and the University of Lappeenranta are at the top of the scale with graduates earning over €35,000 per year while graduates from the University of Eastern Finland and the University of Lapland earn less, around €32,000 per year. Overall, the variation in returns between graduates from different universities after accounting for observable differences varies between €32,100 to €36,200 per year.

[36]These figures, as well as the rest of the figures in this section, have been generated from the regression results. The figures are produced by computing the adjusted means and converted into earnings per year to make the results more tangible and allow for visual interpretation of the regression results. The confidence intervals are implied by the standard errors of the estimations of Equation (1) and (2). For a thorough description of the margins command used, see Mitchell (2012).

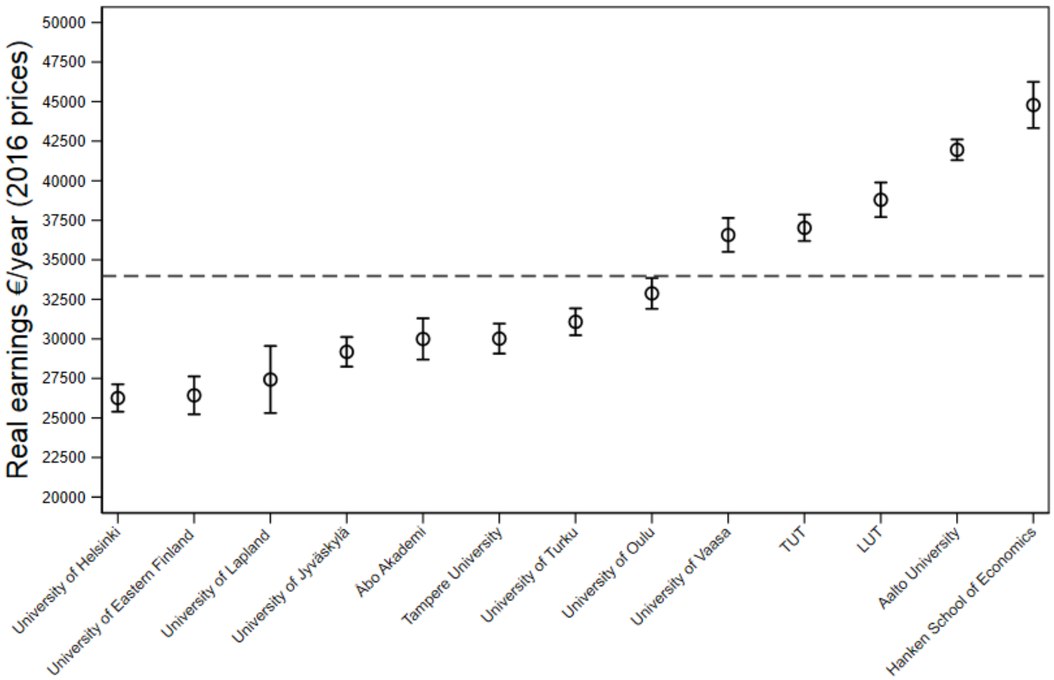

Figure 11: University raw earnings

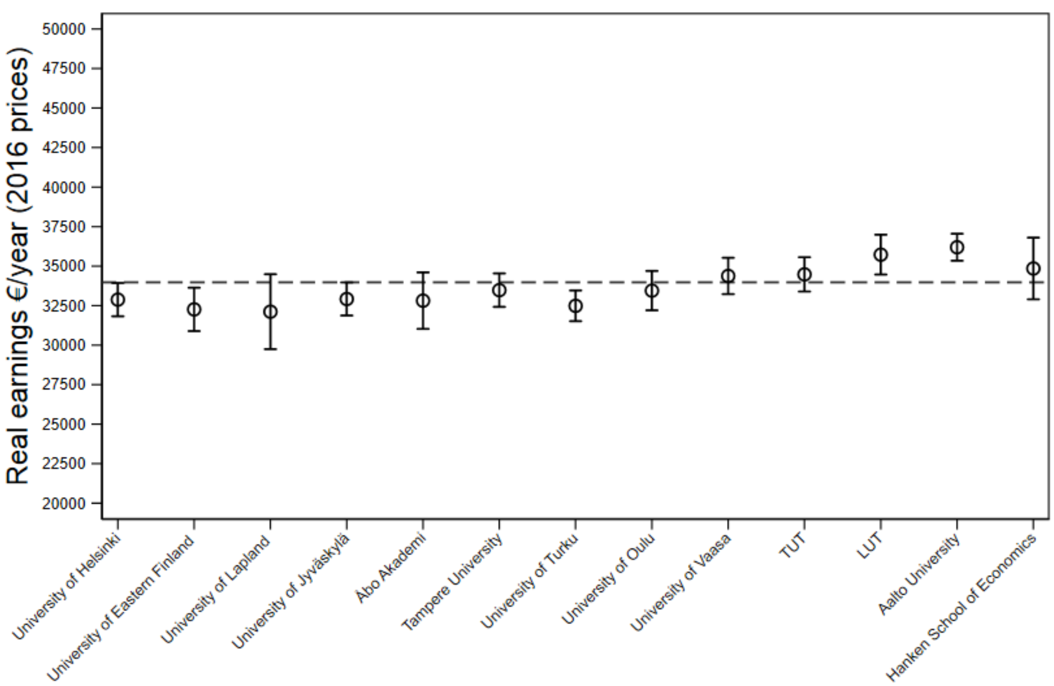

Figure 12: University estimates with full set of controls

Figures 13 and 14 likewise present graphically the raw average earnings and the preferred specification estimates for UAS graduates. In this case, the dashed line shows the average earnings of individuals included in the UAS sample which is slightly lower than in the university sample, €33,367 per year.[37] In figure 13, without any controls, there also exists significant fluctuation in graduate earnings per year between different UAS. After introducing the full set of controls in the UAS sample, Figure 14 illustrates that there is a slight convergence from the bottom and top half of the earnings distribution towards the average earnings of all UAS graduates. Yet, there still are some earnings differences also between UAS. The overall graduate earnings variation is a bit higher in the UAS sample compared to the university sample as the institution returns vary approximately €30,100 to €40,800 per year in the preferred specification.[38]

[37]When examining the difference between the average earnings in the university and UAS samples, it is important to acknowledge that in the UAS sample there are more high earning fields of study, such as business and technology incorporated in the analysis, compared to the university sample.

[38]When controlling for the field of study in the UAS sample, the UAS estimates with humanities related fields, such as Diaconia and Humak, increase considerably. See the difference in Table 9.

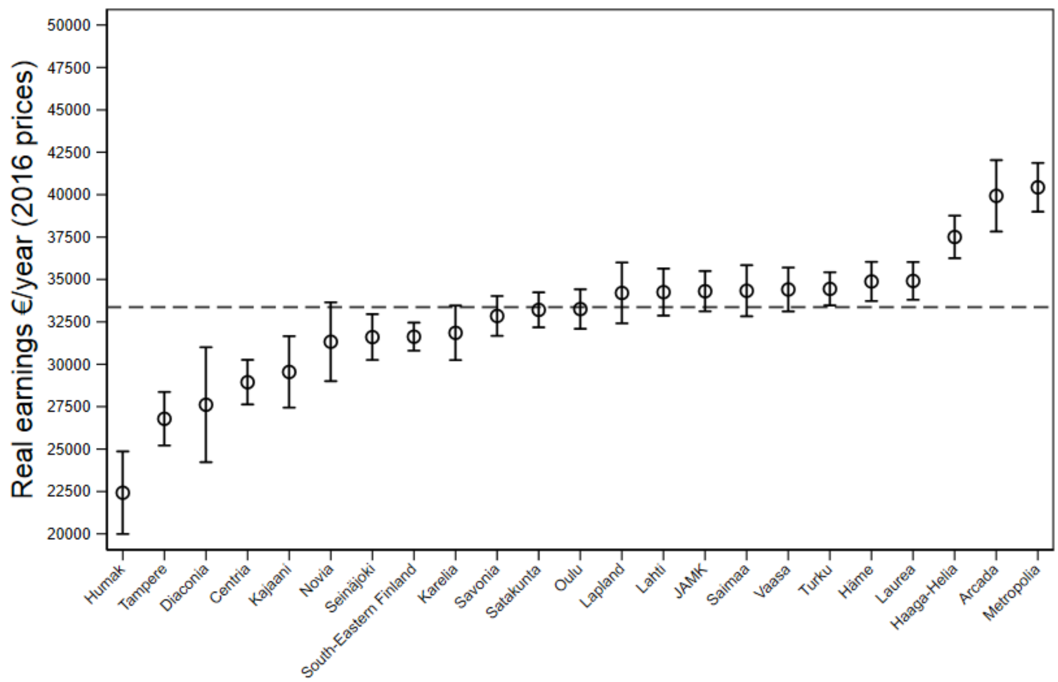

Figure 13: UAS raw earnings

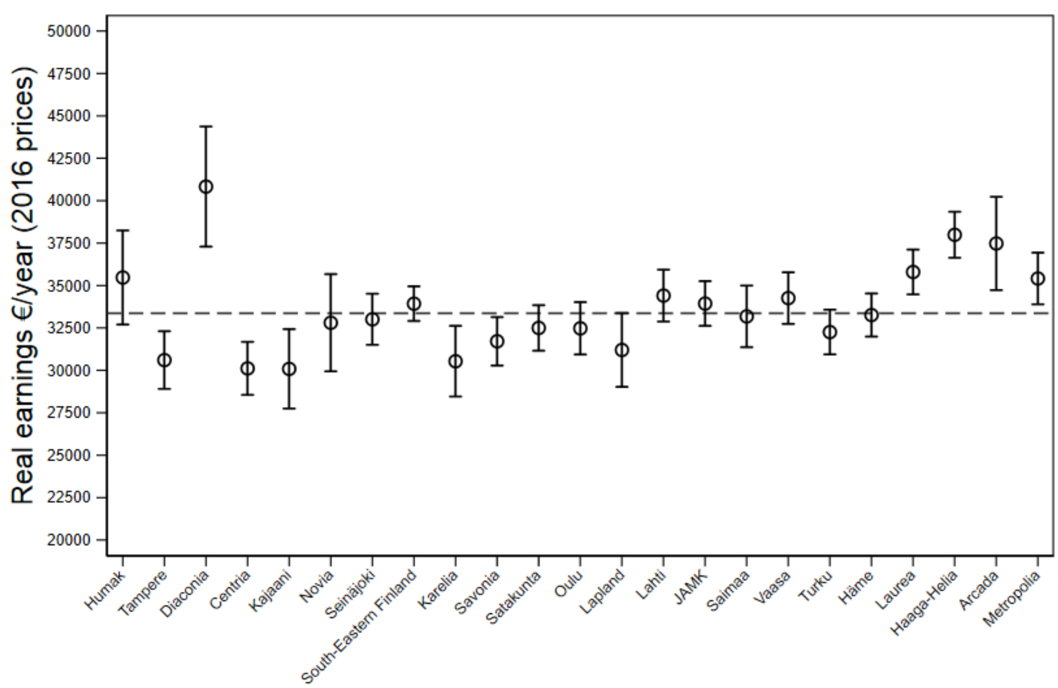

Figure 14: UAS estimates with full set of controls

As discussed throughout this paper, these results should be interpreted with caution. Even though these estimates control for several background characteristics of graduates, these estimates do not solely reveal the human capital accumulation ability, measured by earnings, of different HEIs. Firstly, students at a specific HEI could have excellent noncognitive skills or a preference to work in high-paid jobs which could then result in higher earnings for those HEI graduates. These factors are not controlled in this study which can lead to upward bias estimates for a specific HEI. Secondly, these results do not separate the different mechanisms of human capital accumulation and signalling channels. If employers are more likely to hire graduates from a certain HEI because they perceive students attending that HEI serves as a signal of high quality of prospective employees, then this might result in higher returns for an HEI. Therefore, in this case, it is not only the increased human capital that the HEI has conferred upon its graduates. Finally, these results do not separate regional effects from the HEI returns. For example, the HEIs used in this analysis are located in different parts of Finland. Graduates from HEIs located in Helsinki might have better access to the Helsinki labour market which also has higher earnings. Therefore, particular parts of Finland can be more favourable than others in terms of opportunities for increasing graduate salaries. Overall, it is important to acknowledge that some of the differences in returns arise because of different locations of HEIs.

Summarising the results from the paper thus far, there initially appears to be rather substantial earnings differences between graduates from different HEIs. However, when conditioning on several observable characteristics there is a significant reduction in the earnings differences. Yet, after controlling for several factors, there still exists some earnings differences between graduates from certain HEIs. University graduate earnings differentials vary in the scope of €4,100 per year and UAS graduate around €7,900 per year between the HEIs. As the average graduate earnings per year is between €33,000 and €34,000 in the samples, these earnings differences between institutions account for variation to some extent if these differences remain or grow over the lifecycle. Furthermore, these results suggest more variation in graduates' earnings compared to previous evidence from the Nordics. Nevertheless, on examination of the preferred specification it is also clear that only a few of the HEI estimates are statistically significant.

6.2 Field of study estimates

Next, the focus is on the estimates of the return from studying different fields of study. The field of study estimates are divided into four categories in the university sample; business, humanities, social sciences and technology. The UAS sample, instead, is divided into three fields: business, humanities and technology. This section follows the same empirical logic as with the HEI estimates. Tables 10 and 11 show the regression results for the field of study estimates for both samples after accounting for differences in observable student characteristics. In these estimations, an additional control has been added compared to the HEI regression results. Specifically, column (4) adds a control for the HEI in which the student has enrolled. The purpose for this is to eliminate the confounding impact of institutional quality which might be connected to the field of study offered by different HEIs. For instance, humanities might be disproportionately offered by institutions with lower returns. Therefore, it is important to exclude the impact of the HEIs with lower returns from the estimate of the returns to humanities. For both regression tables, humanities is chosen as the reference category. In both samples, Column (1) displays that with a specification with the intercept term alone, the raw earnings returns vary significantly between the different fields. For example, university graduates who studied social sciences earn on average approximately €6,300 more per year than those who studied humanities. In both samples, humanities is the lowest earning field of study. After adding the full set of controls in column (4), which is the preferred specification, there persist large earnings differentials between different fields of study in both samples. Furthermore, conditioning on background characteristics and matriculation examination grades, there appears to be a pattern showing a reduction in some of the estimated returns to high-earning fields of study and increase the estimated returns to low-earning fields of study indicating the fact that, generally, higher-earning degrees attract students with higher earnings potential. In the preferred specification of the university sample, the highest earning field of study is for those graduates who studied business with around €15,300 higher earnings per year compared to humanities graduates. In the UAS sample, the field of technology has the highest earnings. Graduates from this field earn around €8,900 higher earnings per year compared to humanities graduates. These estimates are statistically significant at the 0.01 level. In addition, these results are consistent with previous empirical studies which also find evidence of earnings differences across different fields of study (see, e.g., Altonji et al., 2016; Kirkeboen et al., 2016; Suhonen and Jokinen, 2018).

Table 10: University field of study estimates (in euros)

	(1)	(2)	(3)	(4)
Business	20730.2***	17325.6***	16441.2***	15287.8***
	(416.5)	(434.7)	(454.9)	(508.3)
Social sciences	6336.1***	4919.5***	4952.5***	5124.2***
	(339.7)	(380.4)	(381.2)	(400.2)
Technology	15245.6***	10898.7***	8658.3***	6744.9***
	(311.6)	(379.4)	(475.5)	(690.3)
Humanities	omitted (reference category)			
N	27044	27044	26919	26919
Adj. R-sq	0.109	0.129	0.134	0.135
Background characteristics	NO	YES	YES	YES
ME grades	NO	NO	YES	YES
HEI	NO	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. HEI include controls for the 13 universities used in the university sample.

Table 11: UAS field of study estimates (in euros)

	(1)	(2)	(3)	(4)
Business	8794.9***	7088.9***	6971.3***	8105.1***
	(547.5)	(558.7)	(561.7)	(752.0)
Technology	14737.7***	8116.0***	7536.3***	8946.8***
	(549.5)	(597.0)	(614.6)	(771.9)
Humanities	omitted (reference category)			
N	18490	18490	18388	18388
Adj. R-sq	0.039	0.140	0.144	0.148
Background characteristics	NO	YES	YES	YES
ME grades	NO	NO	YES	YES
HEI	NO	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. HEI include controls for the 23 UAS used in the UAS sample.

The graphical representations of the results are presented in Figure 15 for university graduates and in Figure 16 for UAS graduates. Both figures have the full set of controls incorporated as well as a 95% confidence interval. Again, the dashed line in the figures illustrate the average graduate earnings per year of the sample in question. In the preferred specification, the high earning university business graduates earn around €42,300 per year while humanities graduates earn approximately €27,000 per year. In the UAS sample, the highest earning technology graduates earn around €34,300 per year whereas humanities graduates earn around €25,400 per year.

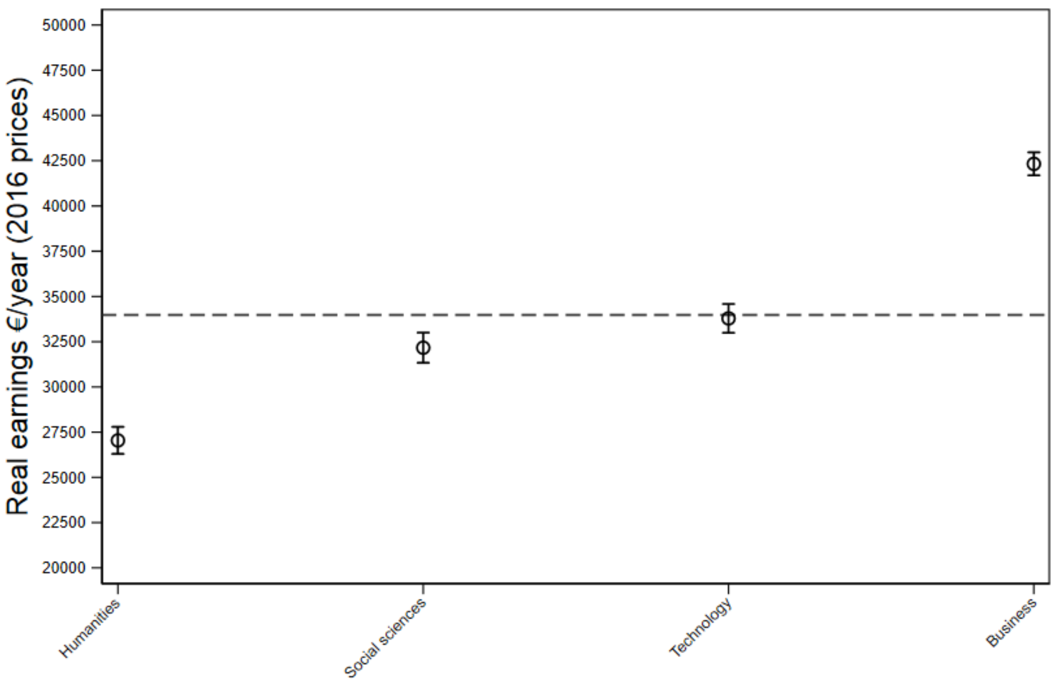

Figure 15: University field of study estimates with full set of controls

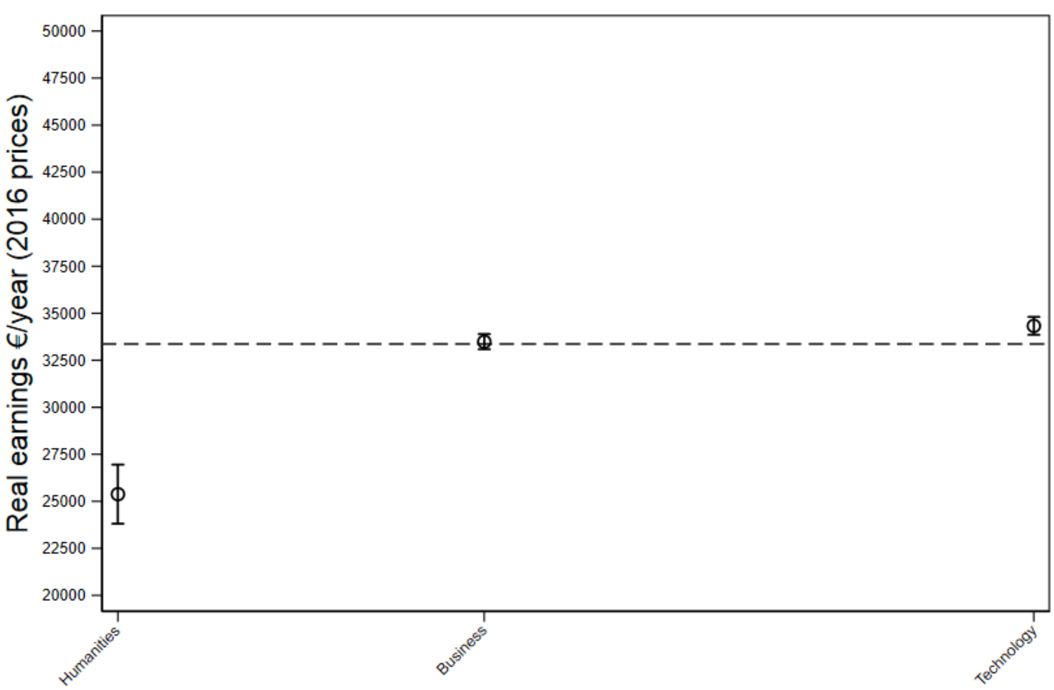

Figure 16: UAS field of study estimates with full set of controls

Overall, the statistically significant field of study estimates show that after accounting for observable student characteristics and institutional quality, the university graduate earnings differentials vary in the range of €15,300 per year and UAS graduate around €8,900 per year between the highest and lowest earning fields of study early in graduates' working careers.

6.3 Field of study - Institution estimates

This section examines the estimated returns for the different field of study-institution combinations, in other words, studying a specific field of study in a particular HEI. All in all, they include results from 78 different combinations. These estimates control for the differences in observable characteristics and are presented graphically in the next set of figures which include a 95% confidence interval. The figures are divided based on the different fields of study used in this analysis. Both university and UAS graduates are incorporated into this analysis. Figures 17 and 18 show the results for humanities, Figures 19 and 20 for technology, Figures 21 and 22 for business and Figure 23 for social sciences.[39] In these figures, the dashed line depicts the average earnings per year in the particular field of study in the sample in question.[40] The Appendix displays the full tables of the regression results.[41]

Taken together, the figures highlight the fact that there are also differences in earnings in studying the same field of study in different HEIs after accounting for observable differences. For instance, Figure 17 shows that the returns from studying humanities is highest at the University of Jyväskylä (€25,200 per year) and lowest at the University of Turku (€21,300 per year). Figure 19, instead, shows that technology graduates at LUT earn on average around €39,000 per year whereas graduates from the same field of study at Åbo Akademi University earn less, approximately €34,900 per year. Furthermore, Figure 20 illustrates that, for instance, the best UAS institutions from the field of technology have graduate returns that are around €7,000 more per year compared to the lowest yielding UAS technology institution. When examining UAS business graduates, Figure 22 shows that studying business, for instance, in Haaga-Helia (€35,000 per year) results in higher earnings per year in comparison to graduates from Tampere (€28,500 per year).

[39] In figures 17 and 18, a lower level of the y-axis (€10,000 – €40,000) was chosen to illustrate the differences between different HEIs for the humanities estimates.

[40] Tables 6 and 7 in section 4 present the average earnings per year by field of study

[41] Tables A3, A4, A5, A6, A7, A8 and A9.

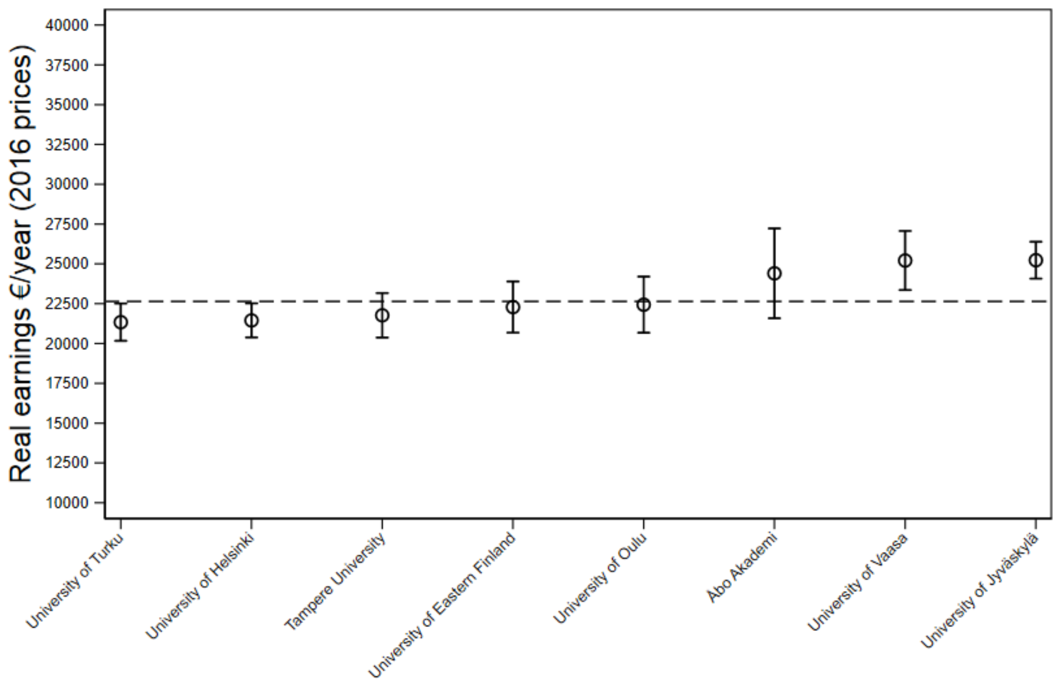

Figure 17: University humanities estimates with full set of controls

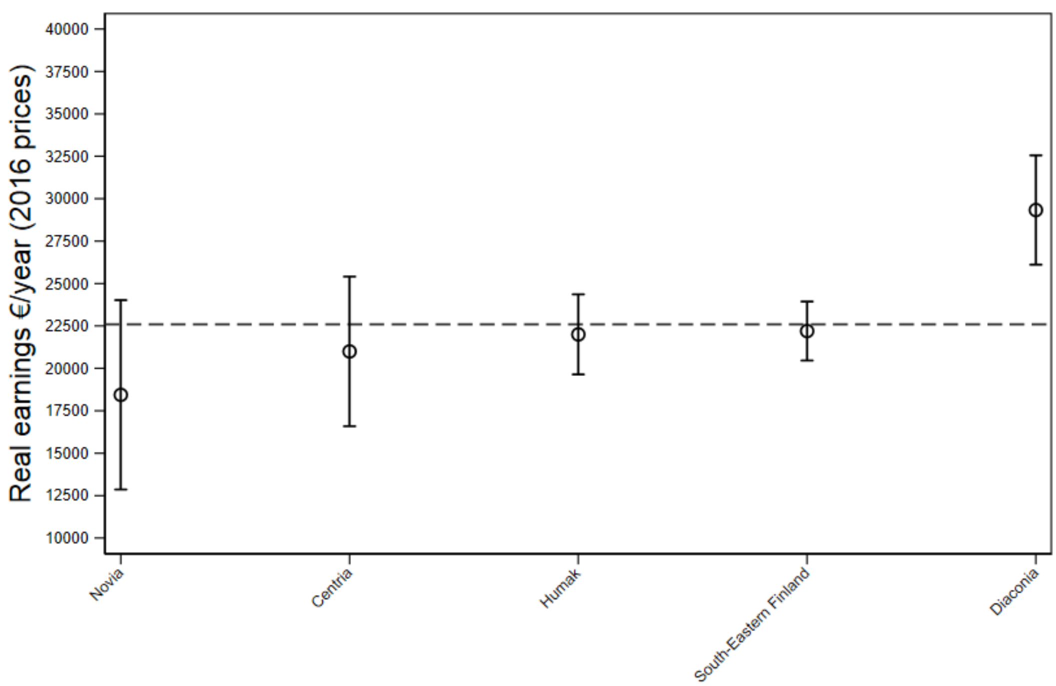

Figure 18: UAS humanities estimates with full set of controls

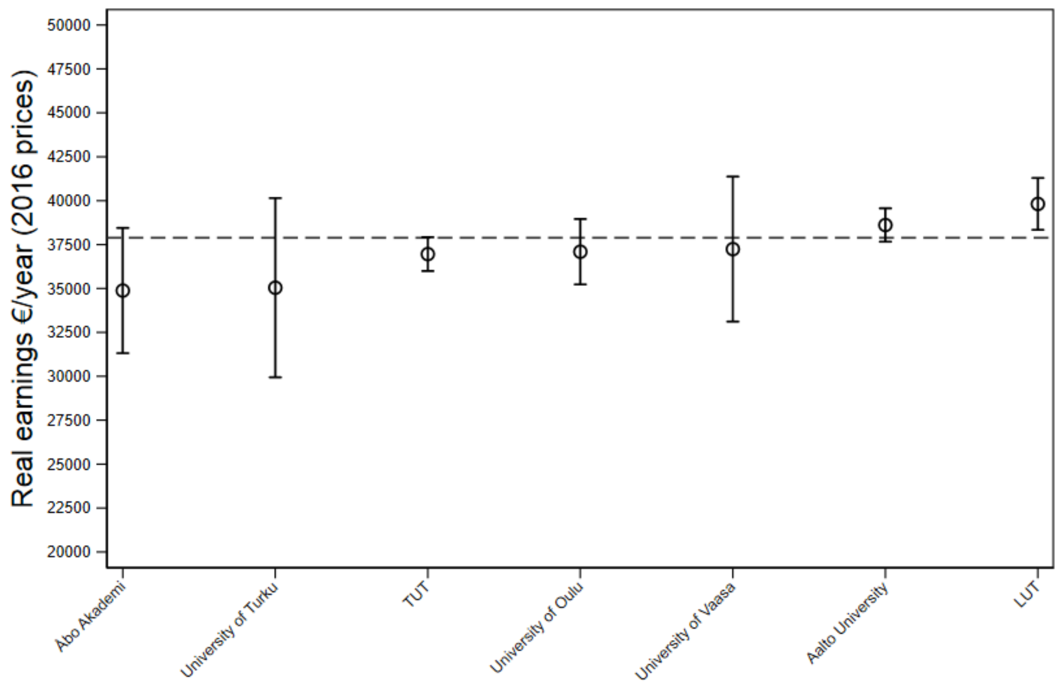

Figure 19: University technology estimates with full set of controls

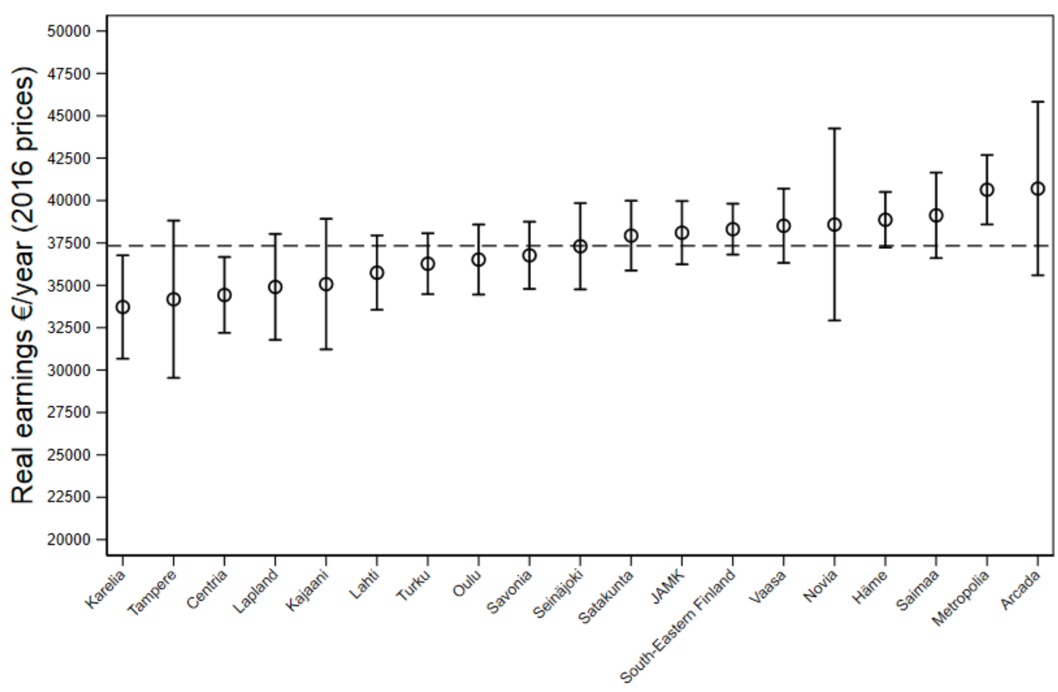

Figure 20: UAS technology estimates with full set of controls

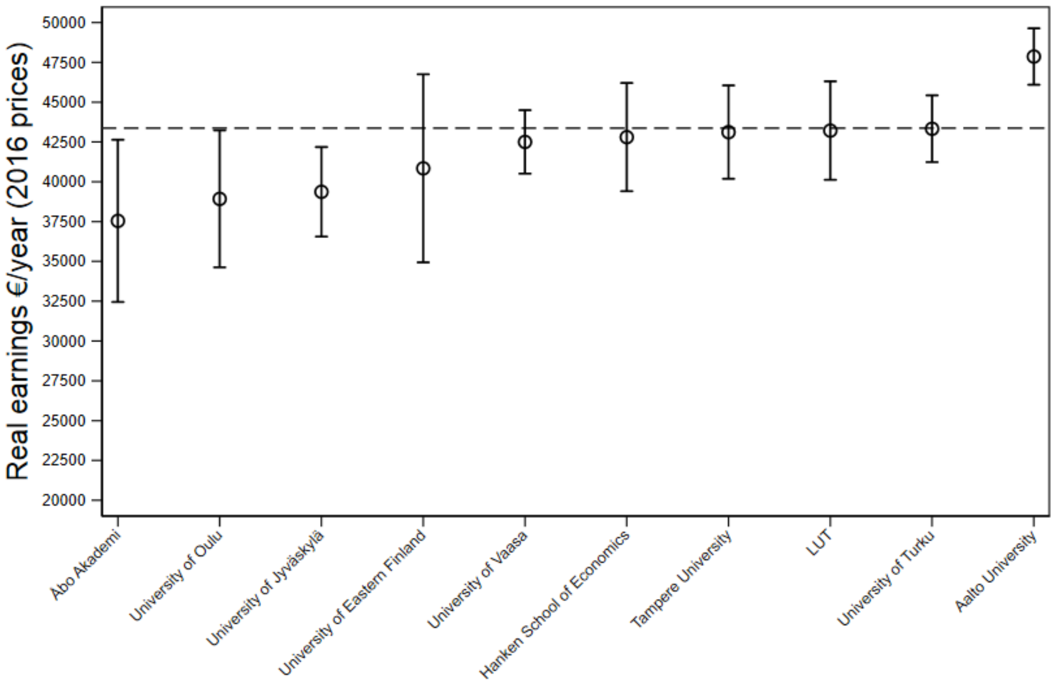

Figure 21: University business estimates with full set of controls

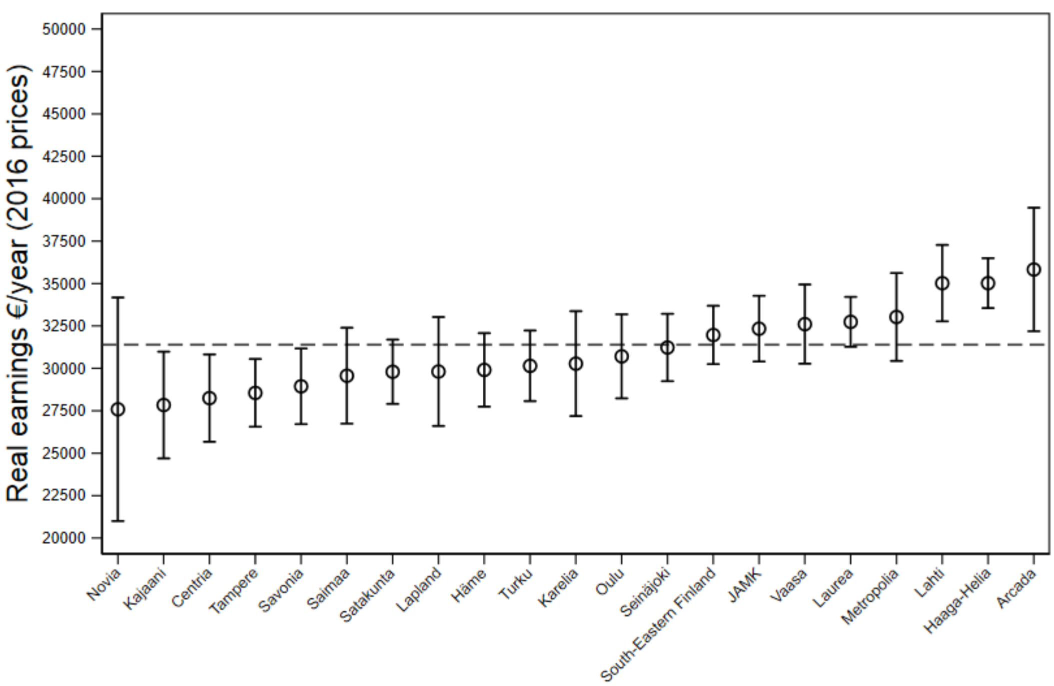

Figure 22: UAS business estimates with full set of controls

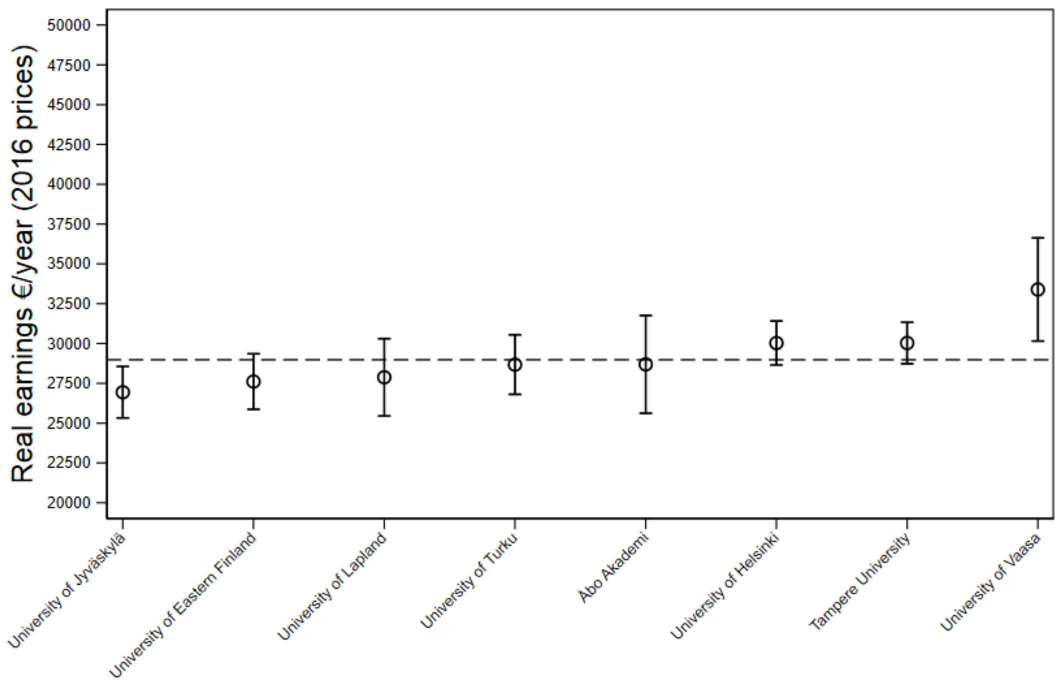

Figure 23: University social sciences estimates with full set of controls

Despite these earnings differences of graduates from the same field of study in different HEIs, the majority of the field of study-institution estimates are not statistically significant. Consequently, they are less precisely estimated. In these figures, the increase in the confidence interval depicts this. Therefore, these field of study-institution estimates should be interpreted with caution as the sample sizes are small (see Tables 1 and 2 in Section 4). Nevertheless, these estimates make an important point. Based on the results, there appears to exist variations in graduates' early career earnings both within HEIs across the different fields of study and within fields of study across HEIs.

6.4 Employment

To present a more holistic picture of the labour market success of graduates, this final section will go through the estimates for the likelihood of gaining employment based on different higher education choices. This section presents the estimates for different HEIs and fields of study, and all the figures have the full set of controls included as well as a 95% confidence interval. Primarily, this section examines the probability of graduates being in employment or self-employment ten years after enrolling in their first higher education degree. For example, a coefficient of say 80% for a particular HEI or field of study would imply that an individual has an 80-percentage point probability of being in employment.

Figures 24 and 25 present the employment estimates by HEI for university and UAS graduates respectively. The dashed line shows the percentage of those who are in employment in each HEI sample. Overall, there exists some variation in the probability of being in employment by HEIs after accounting for students' observable characteristics as well as the field of study choices. For the university sample, the likelihood of graduates being in employment varies between 84 – 87%. In the UAS sample, it varies between 84 – 95%. When comparing Figures 24 and 25, UAS graduates appear to have a slightly higher probability of being in employment. A potential reason for this might be because they offer more vocational courses which could provide better employment prospects. At any rate, in both samples, the employment probabilities are, in general, high which reflects the fact that having a higher education degree in Finland is a good investment against the risk of unemployment.

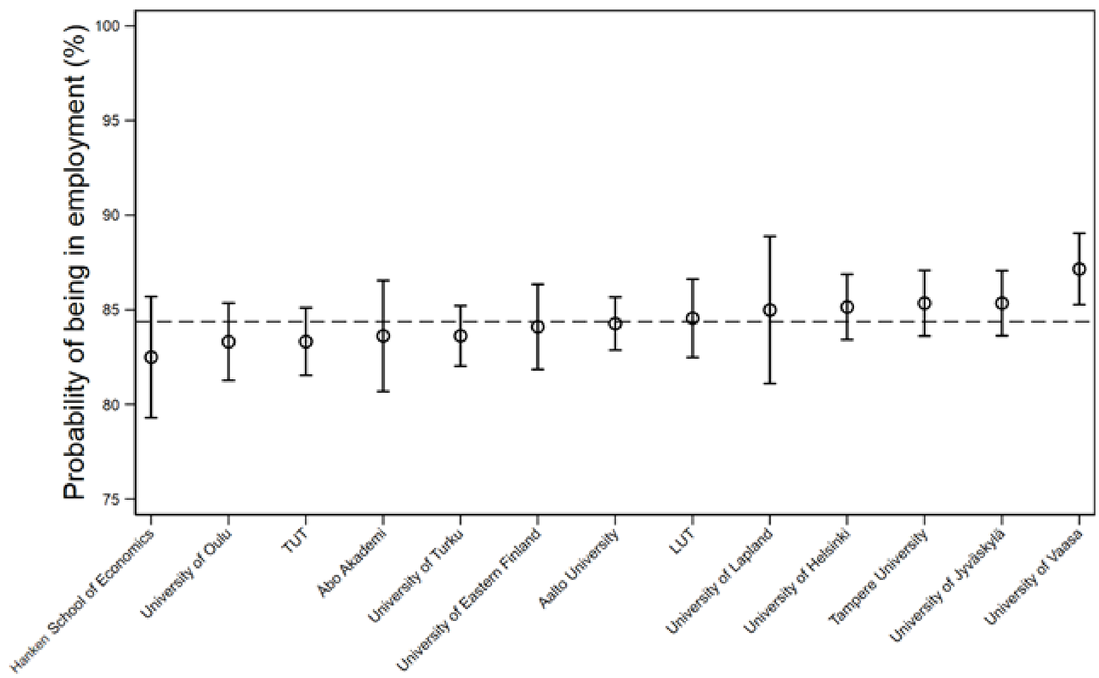

Figure 24: University employment returns with full set of controls

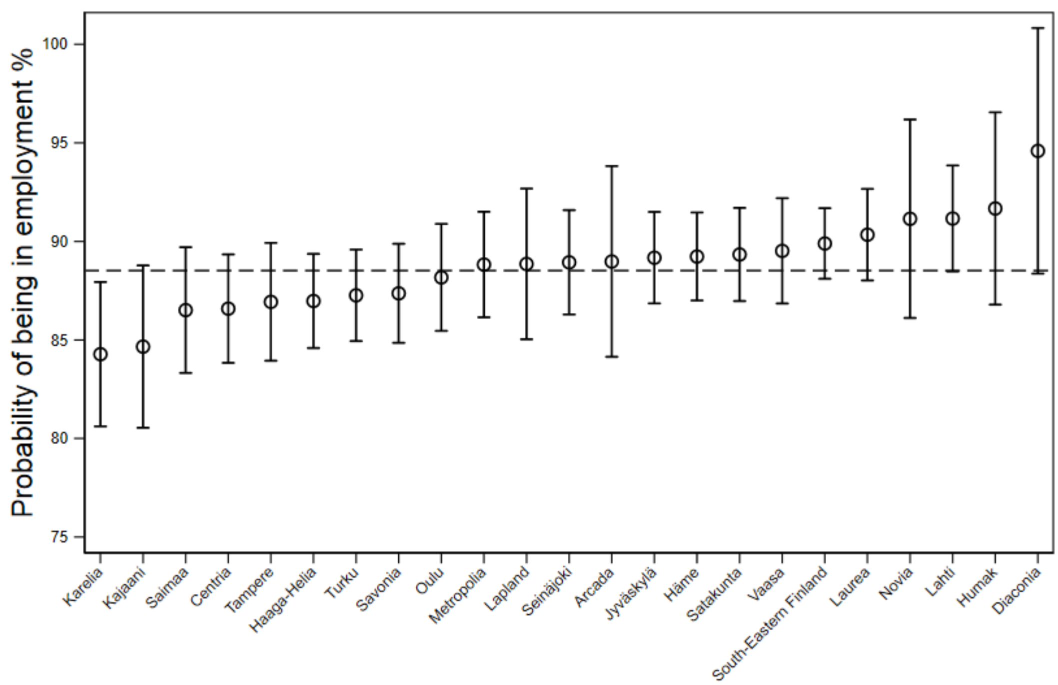

Figure 25: UAS employment returns with full set of controls

Figures 26 and 27 continue to present the employment coefficients by different fields of study for university and UAS graduates respectively. Again, the dashed line displays the percentage of those who are in employment in each sample. In Figure 26, the order seems to follow the same trend as with the earnings estimates by field of study after controlling for background characteristics of students and institutional quality. University graduates from the fields of business and technology have the highest probability of being in employment (86 – 89%) whereas students from the field of humanities have a lower chance (78%). Graduates from the field of social sciences are close to the sample average, with an 84% probability of being in employment. In the UAS sample, the order is similar. Figure 27 illustrates that business (90%) and technology (88%) graduates also have a higher probability of being in employment in comparison to humanities (79%) Overall, in both samples, the difference between humanities and the other fields of study in this analysis is somewhat significant given that the average percentage of those who are in employment is above 84% for university and UAS graduates.

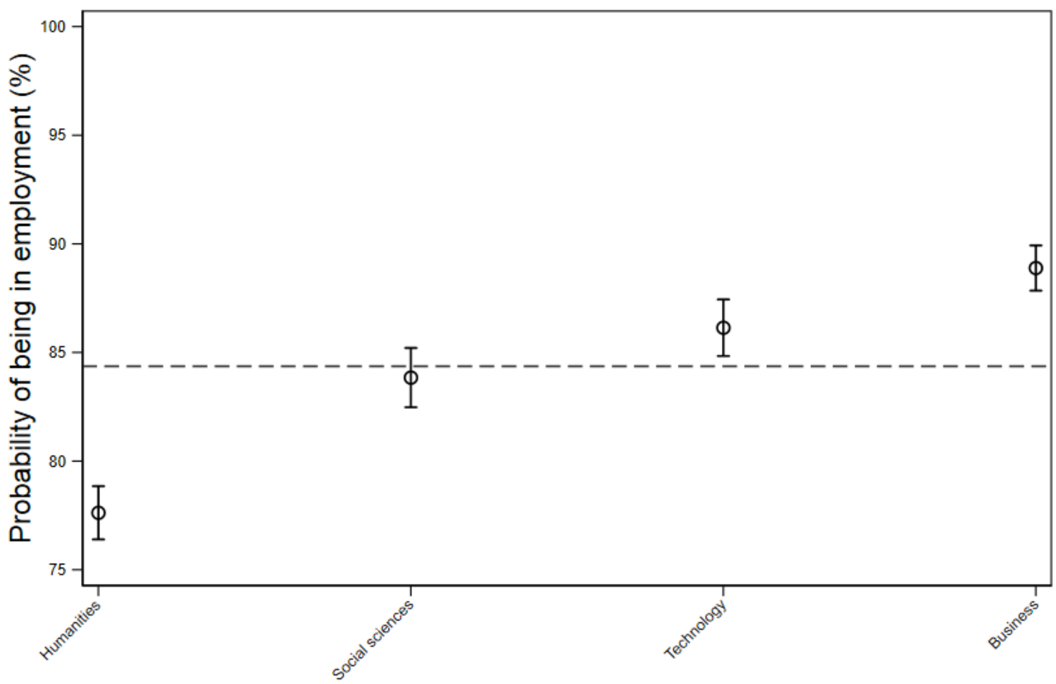

Figure 26: University field of study employment returns with full set of controls

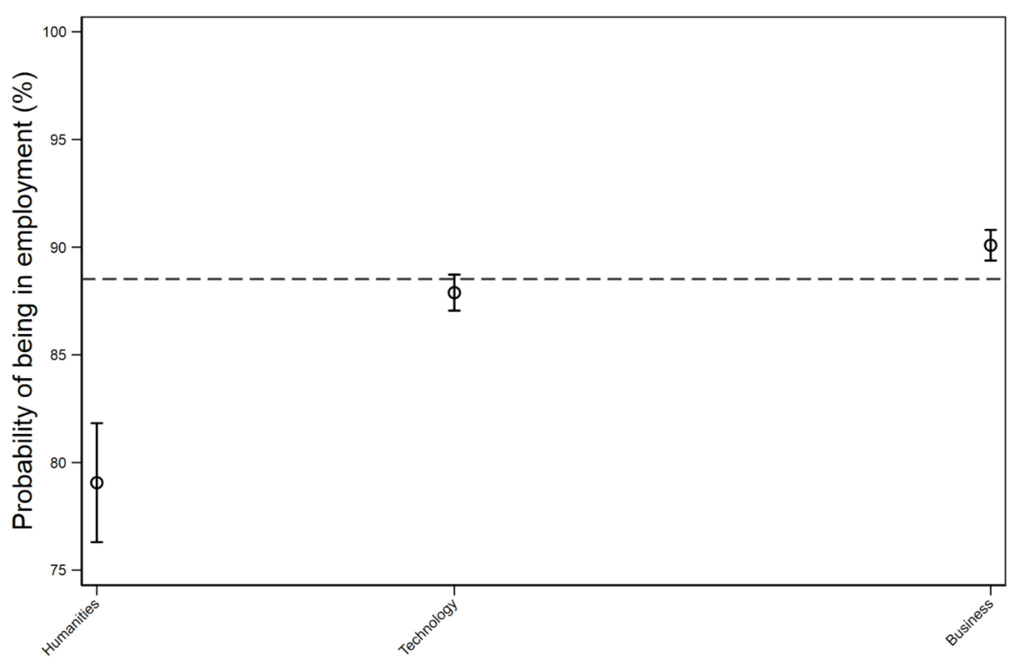

Figure 27: UAS field of study employment returns with full set of controls

7 Conclusions

Past research shows that having a higher education degree in Finland is a profitable investment in terms of labour market outcomes. However, there is a limited amount of information available about the labour market returns in relation to different higher education choices. It is difficult to directly relate the identified returns to specific types of higher education choices because of the non-random nature of selection into higher education. In this thesis, I examine the labour market returns in relation to different higher education choices when accounting for several observable differences in student composition. All in all, this study suggests that some of the raw earnings differences between higher education graduates can be explained by the differences in the characteristics of individuals enrolling in different degrees. In other words, high-earnings fields of study and institutions typically attract students with higher prior academic ability who would have a higher earnings potential in the labour market irrespective of the degree they take. After taking into account prior academic ability and other essential background characteristics, this study finds that the variation in returns for different higher education choices is reduced; however, some differences remain when examining graduate earnings and employment prospects ten years after the entry decision in higher education.

The results show that university graduate earnings differentials vary in the range of €4,100 per year and UAS graduate around €7,900 per year between the HEIs when examining the variation in returns for different institutions. To put it in context, these earnings differences between institutions can account for variation to some extent if these differences remain or grow over the lifecycle as the average graduate's early career earnings per year is between €33,000 and €34,000 in the samples. These results imply more variation in graduates' earnings compared to previous evidence from the Nordics. However, the examination of the preferred specification also reveals that not all of the HEI estimates are statistically significant.

This study also finds that the variation in returns for different fields of study is more substantial. For example, the highest paying field of study for university graduates is business. These degrees result in earnings of over €15,300 more per year compared to a university humanities degree early in graduates' working careers even after accounting for various background characteristics of students and institutional quality. For UAS graduates, studying technology contributes to around €8,900 per year more in comparison to studying humanities.

In addition, this study finds variation in the returns for graduates enrolling in different institutions within the same field of study. For instance, the best UAS institutions from the field of technology have returns that are around €7,000 more per year compared to the lowest yielding UAS technology institution. This implies that there seems to be variation in graduates' early career earnings both within HEIs across the different fields of study and within fields of study across HEIs. These field of study-institution combination estimates should, however, be interpreted with caution because of the small sample sizes used in this analysis.

Lastly, this study shows that there is some variation when examining the probability of graduates being in employment arising from different HEI and field of study choices. On the whole, the probability of being in employment after graduating from any one of the various HEIs is rather high, well above 84%. These high employment figures highlight that having a higher education degree, in general, provides a good insurance against the risk of unemployment. Different field of study choices, however, induce some variation in the employment prospects of graduates. University and UAS graduates from the fields of business and technology have a significantly higher probability of being employed, ranging from 86% to 90%, in comparisons to graduates from the field of humanities of which around 78% are in employment.

Overall, the results of this study suggest that different higher education choices can play an important role in graduates' labour market outcomes. The results of this study, however, should not be interpreted as causal. The differences in earnings may reflect differences in unobservable characteristics between individuals, which this study is not able to take into account with the data and methodology at hand. For instance, different types of unobservable skills and preferences of students also determine labour market outcomes. Furthermore, this study does not observe identical individuals in HEIs and degree programs and, therefore, the impact of a specific course can be different for different types of individuals. Taken together, it is likely that the differences in graduates' labour market outcomes are the combined result of causal impacts of different higher education choices and the characteristics of individuals who enrol in higher education.

Ultimately, the results of this paper prompt suggestions for further research and policy recommendations. A potential avenue for future research would be to investigate what the factors are that are driving the high returns at some HEIs and degree programs. By identifying the teaching methods and other practices that improve the labour market outcomes of graduates, HEIs could adopt these best practices to improve the quality of different degree programs to the benefit of graduates. Furthermore, improving the information available to different stakeholders of the actual labour market value of different higher education degrees could prove to be a worthwhile investment for higher education policy. First of all, it could, in the appropriate context, provide a useful tool alongside other factors in the evaluation of HEIs. Second, if students end up with different labour market outcomes based on their higher education choices, then the provision of precise information about the returns in relation to different higher education degrees would allow young individuals to make more informed decisions when enrolling into post-secondary education. In the end, having objective public information available about the actual labour market outcomes of graduates could act as a public good and allow individuals, policymakers and HEIs to allocate scarce resources to effective use.

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9 Appendix

Table A1: Universities and fields of study included in the analysis

University	Fields of study
Aalto University	Business, Technology
University of Helsinki	Humanities, Social sciences
University of Eastern Finland	Business, Humanities, Social sciences
University of Jyväskylä	Business, Humanities, Social sciences
University of Lapland	Social sciences
Lappeenranta University of Technology (LUT)	Business, Technology
University of Oulu	Business, Humanities, Technology
Hanken School of Economics	Business
Tampere University of Technology (TUT)	Technology
Tampere University	Business, Humanities, Social sciences
University of Turku	Business, Humanities, Social sciences, Technology
University of Vaasa	Business, Humanities, Social sciences, Technology
Åbo Akademi University	Business, Humanities, Social sciences, Technology

Notes: The classification of different fields of study is based on the government decrees on University degrees. The university names reflect the situation in 2016. For example, those individuals included as University of Eastern Finland graduates include also those who went to study at the University of Kuopio and the University of Joensuu. These two universities joined together and formed the University of Eastern Finland in 2010. The names of the degrees associated with each field of study include; Bachelor of Arts (Humanities); Master of Arts (Humanities); Bachelor of Social Sciences; Master of Social Sciences; Bachelor of Science in Technology; Master of Science in Technology; Bachelor of Science (Economics and Business Administration); Master of Science (Economics and Business Administration). More information about the classification of fields of study and degrees used in the university sample can be found here: `https://www.stat.fi/meta/luokitukset/koulutus/versio_en.html`.

Table A2: UAS and fields of study included in the analysis

University of applied sciences	Fields of study
Arcada University of Applied Sciences	Business, Technology
Centria University of Applied Sciences	Business, Humanities, Technology
Diaconia University of Applied Sciences	Humanities
Haaga-Helia University of Applied Sciences	Business
Humak University of Applied Sciences	Humanities
Häme University of Applied Sciences	Business, Technology
JAMK University of Applied Sciences	Business, Technology
South-Eastern Finland University of Applied Sciences	Business, Humanities, Technology
Kajaani University of Applied Sciences	Business, Technology
Karelia University of Applied Sciences	Business, Technology
Lahti University of Applied Sciences	Business, Technology
Lapland University of Applied Sciences	Business, Technology
Laurea University of Applied Sciences	Business
Metropolia University of Applied Sciences	Business, Technology
Oulu University of Applied Sciences	Business, Technology
Saimaa University of Applied Sciences	Business, Technology
Satakunta University of Applied Sciences	Business, Technology
Savonia University of Applied Sciences	Business, Technology
Seinäjoki University of Applied Sciences	Business, Technology
Tampere University of Applied Sciences	Business, Technology
Turku University of Applied Sciences	Business, Technology
Vaasa University of Applied Sciences	Business, Technology
Novia University of Applied Sciences	Business, Humanities, Technology

Notes: The classification of different fields of study is based on the government decrees on UAS. The UAS names reflect the situation in 2017. For example, those individuals included as South-Eastern Finland University of Applied Sciences graduates include those who went to study at Kymenlaakso University of Applied Sciences and Mikkeli University of Applied Sciences. These two UAS joined together and formed the South-Eastern Finland University of Applied Sciences in 2017. In the UAS sample, the five institutions that offer humanities also include some arts-related degrees as it was not possible to separate these with the data at hand. More information about the specific classification of fields of study and degrees used in the UAS sample can be found here: `https://www.stat.fi/meta/luokitukset/koulutusala/001-2016/index_en.html`.

Table A3: University humanities estimates (in euros)

	(1)	(2)	(3)
University of Eastern Finland	-625.5	646.0	839.3
	(811.2)	(979.9)	(1000.8)
University of Jyväskylä	2014.3**	3749.4***	3782.0***
	(692.8)	(865.2)	(866.9)
University of Oulu	-1248.1	842.6	988.9
	(820.8)	(1110.3)	(1117.1)
Tampere University	-781.3	426.5	320.0
	(781.5)	(919.5)	(923.6)
University of Turku	-1449.0**	-203.0	-110.6
	(653.8)	(826.5)	(830.0)
University of Vaasa	1880.8**	3631.4**	3762.1**
	(938.8)	(1150.1)	(1168.5)
Åbo Akademi University	1628.0	2748.6*	2956.6*
	(992.2)	(1644.7)	(1634.8)
University of Helsinki	omitted (reference category)		
N	6129	6129	6100
Adj. R-sq	0.005	0.006	0.008
Background characteristics	NO	YES	YES
ME grades	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. The reference category was chosen on the basis that it represents approximately the average earnings per year of the university humanities graduates in the sample.

Table A4: UAS humanities estimates (in euros)

	(1)	(2)	(3)
Centria	-2936.0	-1222.9	-1200.3
	(1807.4)	(2268.7)	(2395.8)
Diaconia	4965.9**	6358.3**	7134.8***
	(1745.1)	(2085.1)	(2085.4)
Humak	-221.7	116.6	-197.2
	(1312.2)	(1602.2)	(1648.2)
Novia	-4383.1**	-4339.1	-3759.5
	(1561.1)	(2970.6)	(3065.4)
South-Eastern Finland	omitted (reference category)		
N	1002	1002	1001
Adj. R-sq	0.017	0.132	0.140
Background characteristics	NO	YES	YES
ME grades	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. The reference category was chosen on the basis that it represents approximately the average earnings per year of UAS humanities graduates in the sample.

Table A5: University technology estimates (in euros)

	(1)	(2)	(3)
Aalto University	2191.5***	2471.1**	1655.8**
	(567.1)	(756.5)	(773.7)
LUT	943.1	1837.3**	2856.8**
	(713.5)	(892.1)	(903.7)
University of Oulu	-38.98	-602.6	135.2
	(721.9)	(1155.2)	(1163.7)
University of Turku	-866.7	-1925.8	-1915.7
	(2356.8)	(2428.0)	(2454.4)
University of Vaasa	370.1	-601.0	285.3
	(1665.5)	(1825.0)	(1835.9)
Åbo Akademi University	-1774.7	-2547.8	-2076.8
	(1285.9)	(1883.0)	(1883.5)
TUT	omitted (reference category)		
N	9105	9105	9061
Adj. R-sq	0.002	0.020	0.028
Background characteristics	NO	YES	YES
ME grades	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. The reference category was chosen on the basis that it represents approximately the average earnings per year of university technology graduates in the sample.

Table A6: UAS technology estimates (in euros)

	(1)	(2)	(3)
Arcada	7714.4***	5170.6	4432.6
	(2096.9)	(3307.4)	(3344.5)
Centria	-3703.0***	-1883.1	-1841.8
	(1123.5)	(1616.8)	(1627.2)
Häme	1078.8	2564.0**	2593.7**
	(925.3)	(1221.2)	(1226.7)
JAMK	1096.9	1960.0	1830.5
	(940.2)	(1343.0)	(1347.8)
Kajaani	-1279.1	-1842.9	-1202.4
	(1894.5)	(2305.6)	(2313.5)
Karelia	-2524.0**	-2436.6	-2551.8
	(1261.3)	(2041.2)	(2045.7)
Lahti	-3565.6**	-805.8	-526.1
	(1104.7)	(1456.5)	(1459.5)
Lapland	648.8	-1705.2	-1371.5
	(1330.3)	(2054.0)	(2078.3)
Metropolia	4601.7***	4340.9**	4366.4**
	(1110.7)	(1518.3)	(1529.8)
Novia	3231.7**	2753.0	2312.2
	(1466.7)	(3221.2)	(3211.7)
Oulu	-926.1	250.6	246.9
	(934.9)	(1578.4)	(1587.7)
Saimaa	2980.4**	3074.1*	2854.6
	(1257.2)	(1755.5)	(1764.7)
Satakunta	1660.3*	1675.7	1659.9
	(961.7)	(1248.9)	(1255.3)
Savonia	535.6	516.4	495.9
	(950.0)	(1479.8)	(1492.1)
Seinäjoki	-490.4	714.0	1029.4
	(1189.5)	(1588.7)	(1596.7)
Tampere	-9103.9***	-2157.9	-2095.3
	(2700.7)	(2721.2)	(2679.9)
Vaasa	2329.6**	2008.7	2237.9
	(1073.9)	(1510.3)	(1516.9)
South-Eastern Finland	1470.7*	1839.0	2039.6
	(864.6)	(1254.0)	(1260.6)
Turku	omitted (reference category)		
N	7624	7624	7564
Adj. R-sq	0.015	0.102	0.103
Background characteristics	NO	YES	YES
ME grades	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. The reference category was chosen on the basis that it represents approximately the average earnings per year of the UAS technology graduates in the sample.

Table A7: University business estimates (in euros)

	(1)	(2)	(3)
Aalto University	5245.9***	5064.6***	4535.4***
	(1179.6)	(1333.9)	(1337.8)
University of Eastern Finland	-5503.4**	-3974.0	-2486.5
	(2103.0)	(2579.0)	(2614.1)
University of Jyväskylä	-3212.7**	-5051.2**	-3961.4**
	(1283.5)	(1587.7)	(1604.9)
LUT	-1706.1	-1646.0	-117.5
	(1468.4)	(1667.5)	(1720.7)
University of Oulu	-5193.8**	-5792.7**	-4404.8**
	(1665.9)	(2115.4)	(2140.9)
Hanken School of Economics	1764.4	-1376.0	-526.7
	(1455.8)	(2196.6)	(2224.9)
Tampere University	-551.0	-977.3	-210.9
	(1410.7)	(1568.9)	(1580.8)
University of Vaasa	-1211.7	-2335.1*	-825.8
	(1117.7)	(1297.5)	(1317.2)
Åbo Akademi University	-3139.6	-7117.7**	-5785.4*
	(2410.8)	(3002.0)	(3066.3)
University of Turku	omitted (reference category)		
N	6454	6454	6421
Adj. R-sq	0.01	0.060	0.062
Background characteristics	NO	YES	YES
ME grades	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. The reference category was chosen on the basis that it represents approximately the average earnings per year of the university business graduates in the sample.

Table A8: UAS business estimates (in euros)

	(1)	(2)	(3)
Arcada	7881.0***	5932.4**	6027.5**
	(1801.4)	(2607.0)	(2574.2)
Centria	-3040.1**	-1629.7	-1551.6
	(1098.1)	(1421.5)	(1433.6)
Häme	-209.5	339.5	110.4
	(1123.0)	(1381.5)	(1386.2)
Haaga-Helia	8021.7***	5760.9***	5224.5***
	(1052.0)	(1273.4)	(1274.1)
JAMK	1701.6	3014.3**	2540.6*
	(1070.7)	(1351.0)	(1355.7)
Kajaani	-2855.2**	-2065.2	-1960.3
	(1387.0)	(1742.6)	(1751.0)
Karelia	67.69	482.1	478.9
	(1213.0)	(1650.6)	(1654.1)
Lahti	5614.2***	5235.4***	5222.5***
	(1168.0)	(1520.0)	(1517.3)
Lapland	1686.2	-9.061	15.29
	(1308.7)	(1832.1)	(1830.2)
Laurea	5432.0***	3165.1**	2941.4**
	(881.8)	(1230.3)	(1228.8)
Metropolia	9241.1***	3910.2**	3231.5*
	(1588.4)	(1822.3)	(1830.2)
Novia	60.35	-2382.2	-2212.2
	(2970.2)	(3861.1)	(3858.0)
Oulu	421.9	1349.5	910.5
	(1093.4)	(1587.8)	(1587.6)
Saimaa	-358.0	-151.7	-233.2
	(1189.4)	(1600.8)	(1595.6)
Savonia	-2158.2**	-849.1	-857.3
	(970.6)	(1368.5)	(1372.8)
Seinäjoki	-88.47	1532.9	1430.0
	(1029.6)	(1280.0)	(1284.0)
Tampere	-2794.8**	-1342.4	-1244.1
	(954.8)	(1211.2)	(1211.1)
Turku	1913.3**	786.8	350.5
	(965.8)	(1187.4)	(1194.9)
Vaasa	624.3	3179.2**	2808.2**
	(1071.5)	(1402.2)	(1399.4)
South-Eastern Finland	597.3	2140.4*	2168.4*
	(919.0)	(1280.0)	(1286.1)
Satakunta	omitted (reference category)		
N	9864	9864	9823
Adj. R-sq	0.028	0.121	0.126
Background characteristics	NO	YES	YES
ME grades	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. The reference category was chosen on the basis that it represents approximately the average earnings per year of the UAS business graduates in the sample.

Table A9: University social sciences estimates (in euros)

	(1)	(2)	(3)
University of Helsinki	1055.7	303.8	-1.021
	(841.8)	(1053.8)	(1059.5)
University of Eastern Finland	-1298.3	-2610.5**	-2419.7**
	(917.9)	(1082.5)	(1082.5)
University of Jyväskylä	-2887.7**	-2973.8**	-3092.0**
	(907.5)	(992.2)	(995.8)
University of Lapland	-2234.7**	-2236.2	-2152.7
	(1050.1)	(1361.5)	(1372.7)
University of Turku	-1100.5	-1448.0	-1357.7
	(975.9)	(1110.4)	(1111.1)
University of Vaasa	3694.7**	3464.8**	3360.7*
	(1601.7)	(1720.9)	(1722.6)
Åbo Akademi University	-2294.7**	-966.0	-1340.6
	(1070.9)	(1748.5)	(1742.9)
Tampere University	omitted (reference category)		
N	5356	5356	5337
Adj. R-sq	0.005	0.025	0.030
Background characteristics	NO	YES	YES
ME grades	NO	NO	YES

Notes: Robust standard errors in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. All regressions include a constant term. Background characteristics include controls for gender, mother tongue, high school region and measurement year of income. Matriculation examination grades include grades in first language and math. The reference category was chosen on the basis that it represents approximately the average earnings per year of the university social science graduates in the sample.